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Personal. DR. LOUIS BELL, who for the past two years has occupied the editorial chair of THE ELECTRICAL WORLD, will on March 1 retire from it with a view of taking a more direct part in the engineering work that is now entering a period of such tremendous activity. In view of his resignation Mr. Carl Hering, well known in electrical circles as a capable and conscientious technical writer, and who has been connected with THE ELECTRICAL WORLD for some time in that capacity, will be in charge of the technical department of the paper, and will give its readers the benefit of his extended experience in electrical engineering. Dr. Bell has done such excellent work during his connection with THE ELECTRICAL WORLD that he may be expected to take a very prominent part in the commercial development of the electrical industries in whatever branch he may take up active work.

The Electric Light Convention. WE are glad to see that this present Buffalo Convention means business. There never has been a gathering of the National Electric Light Association which promised more useful results. The association has had, on the whole, since the beginning a prosperous career, although more than once dangerous differences have arisen within it. These, however, have now been, for the most part, settled, and the present convention is pre-eminently one of close union of the electric lighting interests represented by the membership of the association. The papers are of a systematic and coherent character, covering live topics that are of interest to every man present, and the organization has good reason to congratulate itself on the efficient efforts of President Huntley in organizing so practical a meeting. It is, probably, a good move to dispense with the elaborate exhibits that have been the fashion at previous conventions. They possess little business value to the exhibitors, and are a source of considerable expense. Their purpose can be served just as efficiently by personal missionary work, and conventions will be relieved from the turmoil ensuing from the attempt to secure adequate accommodations. It is hard to find suitable quarters for the ever increasing number of delegates who attend these meetings, and add ing to this the difficulty of finding an appropriate place for the display of large quantities of electrical exhibits, the problem of a fitting place becomes a very serious one. We congratulate the National Electric Light Association on the management of the present convention, and believe that it will result in putting the whole organization on a firmer and more satisfactory footing than ever before.

The Great Combination. JUDGING from some paragraphs that have appeared in the daily papers, consternation reigns at the Edison offices. There seems to be a feeling abroad that the union of the Thomson-Houston and Edison companies resembles that of the lion and lamb, with the lamb inside. On reflection, however, it appears highly improbable that any devastating revolution is likely to occur in the Edison organization. Unless we read his record wrongly, Mr. C. A. Coffin, who in all probability will be the executive head of the combination, is much too clear-headed and far-sighted to cripple the great corporation of which he is to be the head by wholesale and demoralizing changes. Unquestionably there will be changes, but probably by no means so great or far-reaching as seems to be feared just now. District offices may be consolidated and the general organization made compact and coherent, but it is unlikely that any valuable man will find himself left out in the cold. There is an enormous business to be done, great engineering feats to be performed, and a vast number of details that require the most conscientious and intelligent superintendence. That these grave responsibilities will be placed in the hands of those who are amply competent to handle them can hardly be doubted, but it would appear altogether probable that no thoroughly competent man will suffer from the reorganization. Mr. Coffin's reputation for fair and generous dealing is too well known to need comment here, and, that aside, business policy in such a case would dictate only the elimination of undesirable and superfluous material. The two great companies that have been amalgamated will form a tremendous whole, a greater one than could possibly have resulted from the absorption of either.

Electrical Education in Central Stations. THE thoughtful paper by Mr. E. R. Weeks on libraries for central stations is well fitted to point a moral. It would be a splendid move for every electric light station of any size to establish a suitable library of electrical books, even if quite small, for the use of its employés. As a rule these are a class of men more than ordinarily intelligent, and eager to make use or every opportunity to increase their fitness for the work they have in hand. One cannot give too much encouragement to them in self-improvement and by such assistance as will help them in their daily avocations. Few workmen in electric light plants can afford to buy all the books that they could advantageously read, and the public libraries in most cities are singularly weak in scientific works of every description. To supply every station at the outset with a careful selection of electrical books—even if few in number — and with current electrical journals, is not any considerable additional expense, and there is a strong probability that it will actually pay for itself in a very short time. A man who is anxious to improve his mind will generally be quick to apply that which he learns, and central station managers know well the actual money value of an intelligent and well posted employé, who often has the opportunity to save the company money by a little intelligent care at the point where it is most needed. Stupid men get rapidly eliminated from the business, and, as a rule those who are actually engaged in the care of electric light and power plants will be found anxious for information and quick to appreciate everything which they learn. The wise manager will therefore see the usefulness of educating his men, and will secure a small appropriation for laying in the nucleus of an electrical library. More than that, he can, by a little personal effort, help the good work along and train his men to the thorough appreciation of the advantages offered for self-education, and such philanthropy is of a kind that pays in more ways than one.

Consolidation of Electric Lighting Interests. ELSEWHERE in our columns we publish a considerable amount of correspondence with regard to the union of the two representative bodies of electric central station managers. On the one hand, the National Electric Light Association, with its widespread and influential membership; on the other hand, the Edison Association, that represents most characteristically the incandescent lighting industry in this country. The two really approach each other very nearly in their interests. Many of the Edison men run arc lights, and the majority of the members of the National Electric Light Association operate stations in which lighting of every sort is carried on. With the merging of the Edison General Electric Company into the new and powerful organization that will actually control most of the electrical work in this country, arguments for the separate existence of two electric light associations seem to vanish, for their interests are now brought more nearly together. There is no commercial objection to their union. It would have been far better for the electric lighting industry from the very start had all central station members been willing to forget that they were closely allied to any equipping company long enough to get together once or twice a year for their mutual improvement. The more general the membership of any association the wider its opportunities for usefulness, and there is every reason to believe that the Edison Association would find it to its advantage to join forces with the National Electric Light Association to the end that their common interests may be the more efficiently fostered. In union there is strength, and the occasion is likely to arise quite frequently when concerted effort can help along the business interests of the parties concerned. The tendency has been of late for the National Electric Light Association to become a sort of electrical guild with a closer community of interests and a more compact organization than ever before. The time is ripe, therefore, for an extension of this policy and a firm brotherhood of the electric lighting interests of the country.

A Remarkable Electric Light Station. ON another page we give a brief description of the great electric light station of the Edison Electric Illuminating Company, at the corner of Pearl and Elm streets. It is now in process of construction, but it will be more than a year before it is in active operation. Even then the change from the present temporary plant at that point will be somewhat gradual, so that probably it would be difficult to appoint any specific date at which the new station will go into operation. The plans are of the most interesting character. In the first place they are the first to introduce throughout the gigantic plant connected engines and dynamos, toward which modern practice is now tending. Such enormous combinations become practicable as the size of the station increases, and with 10 to 12 such units in operation the fear of breakdown, which has often hindered the introduction of such apparatus, becomes practically groundless, for the number of individual units is such that even if one of them should unfortunately be crippled no serious interference with the service would ensue. At first 1,500 h. p. triple expansion engines, coupled direct to a pair of huge multipolar dynamos of similar capacity, will be installed, and afterward, as occasion demands, larger units, perhaps of as much as 4,000 or 5,000 h. p., will be introduced. In the next place, an effort will be made to secure the highest possible economy in the generation of power. With this in view, the plant has been designed in accordance with marine practice rather than after the pattern of any of the well-known power stations on land. In fact, in a metropolitan central station almost the same requirements of economy of space exist as in the case of a great steamship. Real estate is costly, and it becomes necessary to condense into the smallest feasible space the largest possible amount of power. The direct coupled units meet this end so far as motive power is concerned, but the most characteristic feature of the new station is the very ingenious arrangement for working the boilers to their highest possible capacity and at the same time saving a large part of the heat which would otherwise be wasted. To this end forced draft will be employed to increase the power of the furnaces and the air heated by radiation from boilers and engines is to be collected and returned to the closed ash pits. Engine and boiler rooms will be tightly closed and under a slight air pressure. The air heated by radiation from the plant will rise into hot air chambers and thence be drawn through heaters in the stack, so that by the time it reaches the fires the temperature will be so high as to return no small amount of heat to the furnaces. This practice has already been in use on steamships in a modified form, but until now has not been proposed for such use as that to which it will shortly be put. Beside all this the boilers themselves are to be constructed to carry a steam pressure of 200 or 300 pounds, thus both enabling the engines to be worked efficiently and reducing the boiler space necessary. Altogether the Elm street station bids fair to be unique in the perfection of its appointments, and reflects great credit on Messrs. Bowker and Van Vleck, to whose persistent energy the present arrangement is due.

Latest Foreign Electrical News.

(By Cable from Our Own Correspondent.)

London, Feb. 19, 1891.—The commissioners having the matter in charge have just issued a set of what are regarded as very stringent regulations governing the installation of electric lighting plants in theatres. The regulations apply especially to the provision of safe and reliable wiring.

At a meeting of the London Chamber of Commerce held last Monday the position of the commercial community with regard to the present telephone service of London was freely discussed, and indeed this subject was the principal one for which the meeting was called.

It is announced that a motion will be made in a short time in the House of Commons urging the purchase and control by the Government of all the telephones in the United Kingdom. The movement has many supporters.

The Electrical Committee of the Royal Commission having in charge the World's Fair interests has issued a circular in which an urgent appeal is made to English electricians and electrical firms to co-operate and send exhibits and representatives whenever possible to the Exposition at Chicago.

The adoption of electric light and power plants in mining operations is becoming quite general in this country, a fact shown by the numerous orders which have recently been placed for pumping, hauling, cutting and lighting machinery for a number of prominent mines.

A company has just been formed for exploiting the Johnstone system of underground conduits in England. This system is not new in America, but has not before been actively pushed in this country.

Those actively engaged in the commercial development of long distance transmission of light and power by alternating currents will be interested to learn that Mr. Ferranti has disposed of his patents covering the concentric mains used in connection with the Ferranti transmission from the Deptford station. A separate company has been organized to control these patents, and it is understood that Mr. Ferranti received a very substantial consideration for his interests in what is generally considered a very important method of transmission.

The lecture recently delivered by Mr. Nikola Tesla before the Institution of Electrical Engineers on his very elaborate experimental investigation of the phenomena accompanying currents of high frequency still continues to be the subject of much discussion by both the scientific and daily press of England. It is probable that no American scientific lecturer ever created more interest in any subject or drew out more comments from the scientific men of England than Mr. Tesla has done by a single lecture. He left England a day or two ago, going to France, and it is announced that he will lecture to-day in Paris on the subject mentioned above, which has already gained for him a wide reputation in European countries, especially in France, Italy and Germany.

The papers read this week by Messrs. Siemens and Preece before the Institution of Electrical Engineers on the subject of the insulation of electric light cables provoked a lengthy and very interesting discussion. The general opinion seemed to be that minute specifications on this subject are absolutely useless, as it was impossible to obtain in this way any thorough or reliable work, owing to the recognized fact that there are entirely too many tricks of the trade. It was considered much better in all cases to rely upon the honesty of the manufacturer to furnish good and sufficient insulation.

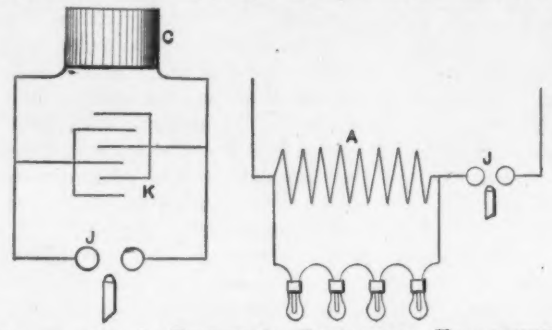
Further Experiments with Condenser Spark and Air Jet.

BY ELIHU THOMSON.

In a prior communication I described some effects which were obtained by the induction of Leyden jar or condenser discharges passing through coils or helices upon other coils or helices placed in inductive relation with the former, and the effects of the use of an air jet or blast upon the spark discharge of a condenser as acting to enhance the inductive effects of the discharge were alluded to.

It is my purpose in the present paper to still further emphasize the novel actions brought about by allowing a stream of air to play upon the discharge obtained from a condenser connected to the terminals of a high potential coil, such as a secondary whose primary is fed by alternating currents of any frequency.

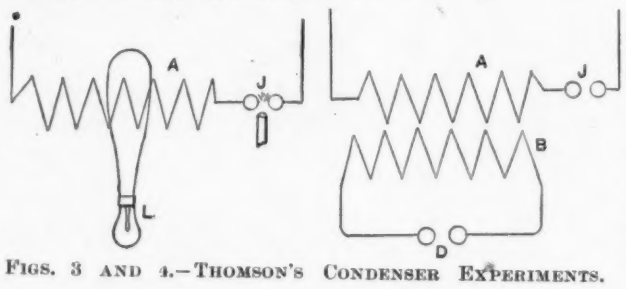
Fig. 1 typifies this arrangement. *C* represents a coil which may give from 10,000 to 20,000 volts as a secondary to a suitable primary fed with alternating currents of suitable voltage. The terminals of this coil are connected to the condenser *K*, as indicated, and the discharge of this condenser is effected by means of terminals at *J*, and an air jet is allowed to play upon the discharge at *J* for the purpose of making use of discharges of very high frequency. In other words, the inductive effects of the discharge passing across the gap *J*, which without the presence of the air jet would be quite feeble, may be enormously enhanced, and represent in fact the passage of currents of extraordinary frequency. Thus, in Fig. 2, if a coil *A* of a few turns of heavy copper wire, even as large as a quarter of an inch in diameter, and, say 15 to 20 turns, wound



Figs. 1 and 2.—Thomson's Condenser Experiments.

to a diameter of about six inches, be interposed in the path of the discharge, or in series with the discharge terminals at *J*, the self-inductive effects of this coil are such that a number of incandescent lamps in series are lighted in shunt to it. Without the air jet at *J* the lamps do not incandesce. This experiment shows the presence of enormous self-induction in *A*, as its actual resistance can be but a very small fraction of an ohm. The presence of such high self-inductive actions in *A* naturally suggests that it may be used as a primary, and produce strong inductions in a parallel circuit. Thus, in Fig. 3, if a single turn be taken around the coil *A* and an incandescent lamp *L*, demanding 25 volts and 2 ampères of current, be connected across the terminals of the single turn, as shown, the lamp at *L* is lighted by the inductive effects, but this does not occur without the air jet at *J*.

Another demonstration of the extremely high frequency of the discharges is indicated in Fig. 9, where two or three turns of conductor are placed in inductive relation to the coil *A*, such as are indicated at *B*. In the figure they are indicated as being separated, but it is to be assumed that

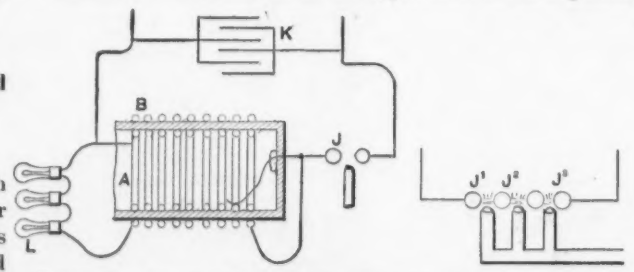


Figs. 3 and 4.—Thomson's Condenser Experiments.

they are wrapped around the coil *A* and perfectly insulated therefrom.

Several turns in *B* are sufficient to illuminate the lamp at *L*, depending upon its voltage and its resistance, even though its terminals are solidly shunted by a heavy copper wire *W* several feet in length. This experiment is somewhat similar to one of Mr. Tesla's experiments in that it depends upon the enormous frequency of the discharges in *B*. The effects are practically *nil* without the air jet playing at *J*. If the coils *A* and *B* be employed as a simple induction coil without an iron core it is found that at a distance of a quarter of an inch at *J* with the air jet passing, very heavy thick sparks pass at *D*, which space may be made three-quarters of an inch in length, the sparks resembling Leyden jar discharges, although the number of turns in *B* are only 20 and in *A* about 10. Both coils are constructed of very heavy copper wire and the turns kept apart, the average diameter of the coils being six inches.

In Fig. 5 is shown a modification in which the outer coil, consisting of about 20 turns of copper wire about a quarter



Figs. 5 and 6.—Thomson's Condenser Experiments.

of an inch in diameter, and the inner coil about 12 turns of somewhat similar gauge, are connected together so as to form, as it were, a closed circuit with each other through the lamps at *L*. The discharges are sent through the system as before by the air jet spark at *J* from the condenser *K* fed by high potential alternating current of 10,000 to 20,000 volts. The lamps at *L* are brilliantly lighted in this experiment. Variations of the effective length of the single coil *A*, which is made of bare wire, can be obtained by a sliding contact, as indicated in the figure. This contact may be made to include more or less of the turns of *A*.

A modification of the experiment Fig. 5 is shown in Fig. 8 in which two coils *A* and *B* are connected in multiple, but the coil *A* is connected through the lamps, which are brought to high brilliancy on the passage of the discharges at *J* with the air jet playing thereon. The coil *B* has the greater number of turns in this experiment and probably feeds its lamps through the coil *A* by a sort of local current flowing through the two coils in series, though this is very difficult to determine. If on the passage of the discharges across *J* there are unequal inductions in the coils *A* and *B*, which set up currents local to the lamps, we would have an action analogous to the flow of current locally to two coils connected in multiple arc when they are in unequal position with respect to a changing magnetic field, causing an inequality of electromotive forces to exist in them.

Fig. 7 shows that with the coils connected in multiple, even though their turns be unequal, it is easy to light a lamp *L* which spans a few of the turns in the outer coil. The lamp used in this case was a 100-volt lamp. The vigor of the self-inductive actions is certainly remarkable, and with the ordinary periodicities of alternating current, namely, 125 or 250 alternations per second initially used, effects due to very high frequencies are very readily obtained. The actions appear to be more vigorous the larger the condensing surface in *K*, the longer the spark at *J*, and the more vigorous the air jet used. The air jet hitherto employed by me has been of very moderate pressure, and I expect to increase its force with the construction of a much larger apparatus for getting these inductive effects.

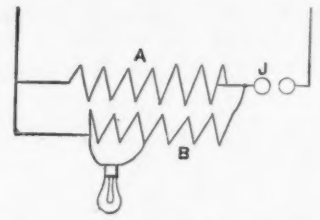
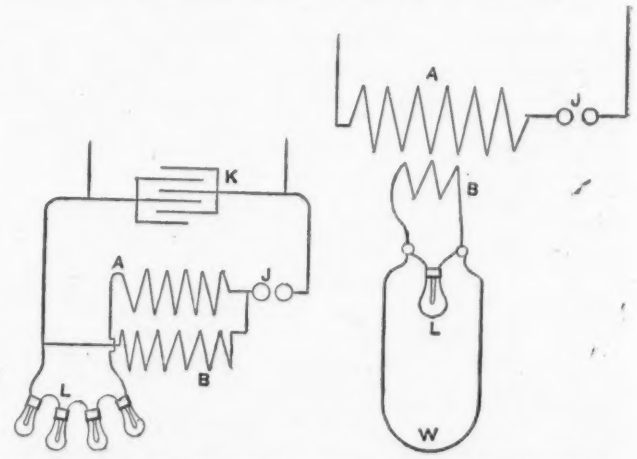


Fig. 7.—Thomson's Condenser Experiments.

It would appear that we have in the air jet and the spark discharge a partial solution of the problem of obtaining very high frequencies in a fairly continuous manner. Fig. 6 shows an arrangement which may be found more effective when working with very powerful apparatus, that is, a series of spark gaps, J^1, J^2, J^3, are each of them provided with with air jets blowing therethrough. A much higher potential will be required to leap these combined spark gaps, while the extinguishing action, or the blowing action of the jets, will be equally vigorous in each space.

The apparatus is so simple and of so little cost to construct even for obtaining, by inductive actions of this character, sparks of great length and extremely high voltage, that it is contemplated to construct a much larger apparatus than that which has hitherto been used. The coil *B* in these experiments, while made of a few turns of heavy, coarse wire, was in my former communication described as constructed of a much larger number of turns of fine wire immersed in oil, and it was shown that torrents of long sparks could readily be obtained therefrom. The ratios of inductions between the coils *A* and *B* seem to be approximately those in an ordinary transformer, and while it is very difficult to estimate from the length of spark alone the actual voltage existing, yet it is certainly true that very many thousands of volts potential difference exist between the terminals during the passage of such sparks



Figs. 8 and 9.—Thomson's Condenser Experiments.

as 7 and 8 inches in length. The striking distance, however, appears to increase much more rapidly than the potential, and if the law holds good it would appear to be easy to secure sparks of very great length by extending the scale of my experiments. It may be remarked here that in reference to striking distance it is a question whether there is not a certain potential which from a certain sized terminal will strike at any distance. It would appear that in order to prevent the discharge from passing into the air either in the form of a brush or a discharge connecting the terminals, the terminals themselves should be made in the form of larger and larger poles kept more perfectly smooth the higher the potential worked with, and that for voltages as high as 200,000 or 300,000 terminals tipped with small balls would act practically as points and allow discharge into the air in the form of a brush discharge, if this potential could not actually cause a leap between the terminals.

General Historical Review of the National Electric Light Association.

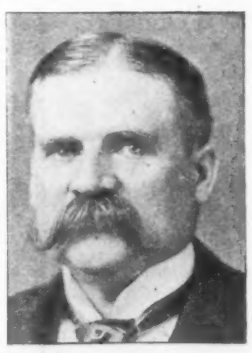
A PRAIRIE ZEPHYR whisked around the corners of the Windy City on Feb. 25, 1885, and touched up the noses and ears of even the most hardened natives, while it made it especially interesting for a little throng of visitors from more temperate climes that had assembled at the Grand Pacific Hotel that day for the initiatory convention of what was afterward to be the National Electric Light Association.

Some time before the advisability of a general gathering of those who were interested in the then young but vigorous and promising industry of electric lighting had been talked about by a few enthusiasts, most of whose names are very familiar to the electrical public of to-day. Mr. G. S. Bowen, Mr. Charles A. Brown and Mr. F. S. Terry were the chief conspirators, and they were fortunate enough to find considerable sympathy among their co-laborers in the electrical section of the moral vineyard.

COMING together on the momentous day above mentioned, about 90 gentlemen were present at the appointed place to see what could be done to bring together the electric lighting interests of these United States. They represented every sort of electrical industry. Central station men were out in force. The supply contingent was there, as now, on hand and ready for the fray, with a few o'ess switches and cut-outs, perhaps, than is usual at the present period of the world's history, but with the same enthusiastic greeting, and the same captivating smile. Of course, the modest but ubiquitous newspaper man was there, to hold as 'twere

the mirror up to nature. The scientific sponsor of the affair was Prof. Elisha Gray, and all hands pulled together with the result of forming the powerful and influential organization now in existence.

The first meeting was merely for organization. After the necessary business had been transacted, the delegates were formally welcomed to Chicago by Mayor Carter Harrison, and after a brief address by Prof. Gray the permanent organization was formed.



J. FRANK MORRISON.

The president chosen was J. Frank Morrison, of Baltimore, who has been on deck at nearly every convention since. The vice-presidents were H. M. Cleveland, E. M. Barlow, and J. H. Yarbrough. The secretary was Mr. W. A. Hovey.

The first paper ever read before the National Electric Light Association was on a subject that has been dinned into the public ear ever since—the crosses of electric light with other wires—in this case with telephone wires. Even at that early day the fun had begun and the telephone contingent had a "tale of woe" to tell.

THE ELECTRICAL WORLD TELEGRAPHING A REPORT OF THE FIRST MEETING.

Then the papers proceeded and ended with a friendly conference as to divers points in the conduct of electric lighting plants as then constructed. Some of the papers would read queerly to-day, so little was the art developed, but it was all plain, hard common sense and meant business.

Thursday afternoon the convention adjourned. The electrical papers of course made their first appearance at this very first convention, and THE ELECTRICAL WORLD—that has been on hand and doing its very best to back up the association at every convention since—distinguished itself by telegraphing to New York for the next issue a really quite full report of the proceedings of the convention, consisting of about 4,000 words.

Fortunately, at this first meeting the National Electric Light Association became firmly organized, and the next meeting, the first of the summer conventions, was destined to establish it on a still more secure basis, and bring together a larger and more enthusiastic body of delegates.

NEW YORK was the place of the second general convention, on Aug. 18 and 19. The time did not agree with the place and the climate particularly well, and the result was an attendance that, although enthusiastic, was not especially large. Nevertheless, a good deal of business was done, and right then and there began the endless debate over the associate and active membership that has been the anti-mascot of the association ever since. It was almost facetiously initiated by an application for active membership from an associate member on the strength of running what it transpired was a one-light arc machine. Then the fun began, and finally a committee was appointed to report at once upon the question.

The papers at this meeting dealt mainly with the every-day operation of stations, and were full of suggestions as to how plants should be run, how lights should be distributed, and the like. At that time tower lighting was specially in vogue, and some interesting information was given as to its general properties aud efficiency. The incandescent lamp, too, began to loom up as a more important factor than it had been in the first convention, and the great question of arc vs. incandescent, with all its attendant ramifications, was fairly inaugurated.

F. S. TERRY.

Another hoodoo turned up later in the meeting in the form of the underground question, and it is somewhat interesting to notice that even then a few progressive spirits had begun to recognize the fact that lighting could be done underground if necessary, although most of the members looked askance at the very suggestion.

The active committee work of the association, too, began at this New York meeting. Singular enough are some of the subjects proposed. To appoint a committee to-day on Electricity as an Illuminant would be amusing indeed, and the committee of one on Incandescent Lighting would be unique in more senses than one.

The supply men were getting in their work, and the exhibits that have been so elaborate at nearly every convention since began to appear. Even the switches with which the pockets of the delegates bulged at each succeeding convention were in the field.

Electricity as a motive power made its salutatory bow at this convention, and a committee consisting of Messrs. Van Depoele and Hochhausen was appointed to consider the subject of motors. Even at this stage of the history of the National Electric Light Association the electrical transmission of power that at this our present convention—and at previous ones—has taken so important a place, was being called to the attention of central station managers as a possible means of increasing their output. It is very interesting to look over the reports of the papers at all these early meetings that one may readily appreciate the enormous growth of the past half-dozen years. It scarcely seems possible that so short a time ago the electric central station was in a state really so undeveloped. Convention by convention one can trace the growth of improvement in apparatus and practice. The deliberations of the National Electric Light Association are an epitomized history of electrical progress.

EDWIN R. WEEKS.

ALWAYS WITH US.

At this New York convention, too, amusement was not altogether forgotten, and many of the delegates combined pleasure with business by inspecting with more or less profit the various interesting plants—electrical and otherwise—about the metropolis.

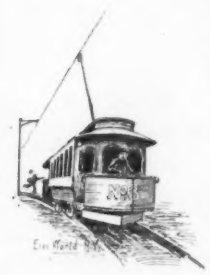
BUT the meeting of the association at Baltimore was really the second convention, and the progress of the year was particularly satisfactory. This time the meeting occupied three days, and the result of the plans that had been matured at the preceding summer convention in New York was abundantly evident in the papers and reports presented. Several committees failed to come to time, but those who did report amply made up for the absent contingent. The history of the electric lamp was put in evidence by Dr. Otto A. Moses in a clear historical discussion of the matter from the days when Davy first produced the arc up to the present. Curiously enough, too, the problem of the direct production of electric current from fuel was brought prominently to notice, and from that time to this has occupied the minds of many inventors, without, however, any results that tend to edification.

C. J. VAN DEPOELE.

Even at the beginning of 1886 the electric light had acquired a considerable commercial history, and the report at that time shows that there were about 95,000 arc lamps and nearly a quarter of a million incandescents in use—a sufficient justification of the association and explanation enough of its growth.

Here at Baltimore, too, for the first time, the electric railway put in an appearance in the deliberations of the convention, as well as the stationary electric motor, and both have been unfailing in their attendance at these deliberations ever since.

Mr. Van Depoele gave a most interesting account of his early electric railway experiments—those experiments which did so much to further the progress of the electric railway by familiarizing the public with its advantages. Since this Baltimore convention the progress of electric traction has been as regularly reported at the meetings of the Association as that of electric lighting itself. One unique feature turned up at the Baltimore meeting, nothing less than the use of the primary battery for electric lighting. It was the first, last, and only time that the subject has been given even semi-serious consideration by the practical electric light men who form the great body of the National Electric Light Association. Mr. E. R. Weeks, who has been so untiring in his services to his electrical brethren, read a rather striking paper on operating expenses that throws a good deal of light on the conditions that existed a few years ago, and many of his suggestions for improvement have been widely developed since.



Another topic that made its initial appearance at Baltimore was the relation of electric lighting to the insurance companies, a subject of never failing interest. Electric lighting in the early days frequently received a black eye from the insurance companies, and from the very beginning the National Electric Light Association has devoted persistent efforts toward breaking down the prejudices that have existed, and so improving practice that there would be no ground for criticism and complaint.

E. A. SPERRY.

But little attention was paid to exhibitions, though, as usual, the supply man was on hand and in increasing numbers, and several minor displays were made. Various points of interest were visited, and many of the delegates had their first ride on an electric railway that had shortly before been put into operation in the outskirts of the city. This road awakened a lively interest in the transmission of power, and helped to open the eyes of the public to what was shortly to come to pass in the way of electrical rapid transit.

DETROIT was the next city to claim the allegiance of the National Electric Light Association, and the convention which assembled on August 31, 1886, was an active and largely attended one. In many respects, the point was well chosen, and particularly so because Detroit was at that time the most prominent example of a city lighted by towers. The results obtained by this method attracted great attention, nearly 600 lamps were thus placed, and almost every delegate took this opportunity to make himself practically familiar with the system.

The first topic that absorbed the attention of the delegates was the question of a uniform wire gauge, over which

there was much wrangling in electrical circles about that time. Finally a new committee was appointed on the subject, and the matter was held over. The everlasting subway question once more turned up for consideration, and Mr. Weeks made a vigorous protest against the enforcement of subways that was then altogether too much in vogue. The association then, as always, objected to putting electric light wires underground where they could not be readily reached, and a kind word for subways would have been the signal for a shower of brickbats had any been available.

As at all the other conventions, the electrical press was out in full force, and at that time THE ELECTRICAL WORLD instituted the innovation of a daily bulletin of the proceedings, a custom which has been kept up at every succeeding convention. The association was beginning to assume even a more thoroughly businesslike character at each meeting, and an elaborate committee report was presented concerning the mutual relations of electric lighting companies and those practical and mutually helpful relations which a combination of kindred interests demanded. Efforts were then as now being made to conduct a thorough bureau of statistics for the benefit of the members of the association, and with about the usual degree of success. Electric motive power again occupied a prominent place, and there was evidence of a gradual elimination of general discussions and a tendency to come down to hard pan and talk business.

T. CARPENTER SMITH.

At Detroit the association struck a snag in the matter of accommodations The growing numbers made it more and more difficult to secure the requisite amount of space, and at nearly every succeeding convention the same cry of lack of room has been raised with anguish, particularly by exhibitors. The National Electric Light Association wants room —lots of it—and the number of cities in the United States where it can get it in sufficient quantity is comparatively limited.

By this time the necessity of more extensive exhibits had made itself felt, and crowding was therefore all the more undesirable. Nevertheless, in spite of these drawbacks, aggravated by hot weather, the convention at Detroit was a marked success. At this meeting the association rejoiced in 125 members, and nearly the full list was on hand. Since then the growth has been more and more rapid. The officers —elected at the previous Baltimore convention—then officiating were President J. F. Morrison and Vice-Presidents H. M. Cleveland and E. R. Weeks. It was decided to hold the next winter convention with the idea of waking up Philadelphia—temporarily, at least—which laudable object in due course of time was brought to pass.

PHILADELPHIA, then, was the scene of the winter convention of 1887. The number of delegates was, naturally, a little larger than at the previous convention and the papers assumed a more important character.

The question that had been raised at Detroit as to wire gauges took particular prominence here, and the committee appointed at the preceding convention reported, giving, as committees frequently do, suggestions that came to naught. The metric gauge was the one proposed, and like other unusual gauges it has fallen into innocuous desuetude. It is a case of one man being able to lead a horse to water and making suggestions, but ten finding their hands more than full in attempting to make him drink. In all human probability we are likely to stick to the B. & S. gauge for a considerable time to come, although perhaps in the sweet by and by the British standard wire gauge may find its way into American usage.

A. J. DECAMP.

Popular prejudice against electric light wires also came in for a share of attention at the hands of Mr. E. R. Weeks. We do not talk so much about it nowadays, but we keep up a terrible thinking all the same.

The electric light fraternity has found to its cost that there is no easier method of injuring a business competitor than raising the hue and cry of public danger. Any fool can spin yarns about electric wires, but an entire army of wise men are totally unable to correct the results of a single adroit lie, which, when concerned with this subject, as always, flies with more than electrical speed.

The electric motor also received a share of attention, and in this Philadelphia convention it was apparent that motors were sufficiently used to make the discussion interesting for all central station managers. Mr. William Baxter, Jr., said his say on the subject, and then Mr. F. J. Sprague took a hand in the general discussion, and read the first of the several important papers that he has presented to the National Electric Light Association. A committee, too, was appointed with reference to fixing rates for motor service, so that from this time on the motor may be said to have become a considerable factor in central station work. Prof. Houston also had something to say upon this topic, and another communication from Mr. Van Depoele dealt with the electric railway side of the motor business.

ELIHU THOMSON.

On the last day of this convention Dr. Otto A. Moses introduced for the first time into the deliberations of the association a veritable porcupine of discord in the shape of a rather enthusiatic paper on the alternating current transformer system. From this time on the alternating current spectre has never ceased to disturb the equanimity of the association, in spite of the fact that at present it has at least an active minority in its favor. There has been no rest for the wicked since the Philadelphia meeting, and every convention since has witnessed a lively skirmish between the alternating and direct contingent.

The winter convention is the time of the annual election and on this occasion Mr. J. F. Morrison was elected a third time as president, while the vice-presidents were E. R. Weeks and A. J. DeCamp. The exhibits formed a very interesting feature of the meeting, and the hotel was temporarily transformed into an electrical exhibition of considerable proportions.

THE STORAGE BATTERY'S DREAM.

A report on electric lighting in Japan, by a native engineer, was the last case on the docket before the election of officers, and after that formality had been gone through it was decided to hold the next meeting in the City of Beans, a unanimous vote making that choice.

BOSTON, as might well have been expected, witnessed a convention of formidable dimensions, beginning on the 9th of August, 1887. The number of delegates was more than double that at any former meeting, rising in fact to 344. It was emphatically a convention of committees, and their reports made the most important part of the proceedings. The legal committee was to the front with elaborate recommendations; then the committee on wire gauge bobbed up again, still clinging desperately to the same old metric proposition, as at the previous convention. The committee worked and brought in work—lots of it—but it failed lamentably to get there, and B. & S. still holds the fort.

A committee on the proper method of insulation of wires and installations of plants also came to the front with a very useful series of suggestions. And then the alternating current spook appeared and the members began to swap yarns about direct and alternating current shocks—an amusement which they have continued with enthusiasm even up to the present time. The discussion of this subject was peculiarly able-bodied.

AN OCCASIONAL VISITOR.

Electrical education found its way into the deliberations of this convention in the form of a paper from Mr. E. R. Weeks. Then ship-lighting, from Lieut. J. B. Murdock, occupied a share of attention. A little later in the game the constitution, an ever-fruitful source of fighting, got in its work on the peace of mind of the delegates.

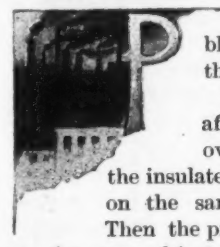
The storage battery made its début at this meeting, with Mr. Mailloux and Mr. Reckenzaun as a pair of very watchful sponsors. It continued to appear for a season or two, but of late has become a wallflower, only taking the floor on rare occasions. Both the storage battery in general use and storage battery traction came up for discussion, and then began the desultory warfare between the advocates of the trolley system and the storage battery men that has been energetically taken up at every opportunity since.

Underground wiring then put in its appearance, and, as usual, there was a cordial little love feast, where all hands joined and every voice was raised in objurgations.

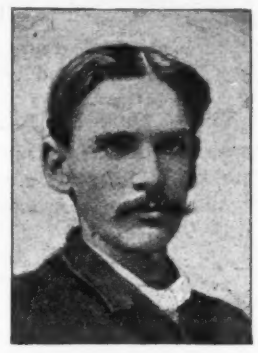
The social features of the Boston convention were more than usually conspicuous, and one afternoon was given over to an inspection of the great Thomson-Houston factories in Lynn.

The exhibits, too, were far more extensive than at any former convention, and this feature of the gathering, until the present convention, has not ceased to grow in prominence.

As for the next ensuing meeting, it was determined to beard the alternating lion in his den, and Pittsburgh was chosen for the winter convention of 1888. So ended the Boston convention, by all odds the most important that had been held up to that time.



PITTSBURGH, then, was the assembling place of the seventh meeting of the National Electric Light Association. The first business of the meeting, after the formal preliminaries were over, was a report of the committee on the insulated wire question, followed by a paper on the same topic by Prof. Elihu Thomson. Then the proceedings were varied by the picking up of a new subject—the effect of electric light currents on compasses and watches. The evil effects of the electric current on watches was more feared then than now, and it was considered an open question whether a ship's compass might not be very seriously affected by the electric lighting plant on board.



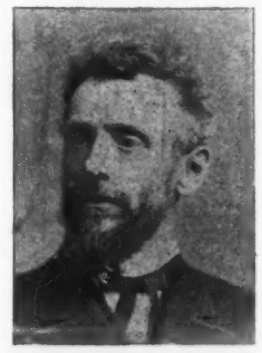
WM. STANLEY, JR.

The next day's session brought out a report from the legal committee, and a paper by Mr. C. A. Schieren on leather belting, introducing especially the leather link belting which has been used with varying success in electric light plants for years.

Then there was a jump from the intensely practical to somewhat theoretical, and the electric motor was taken up and expounded by Dr. G. A. Liebig. His mathematics rather appalled the convention, and the discussion was feeble and somewhat spiritless, for there was a wet blanket of integrals thrown over those who were wont to make discussions lively.

Next a very important paper was read by Mr. W. L. Church, on engines for incandescent light stations. At that time practice was tending toward the use of a considerable number of small engines, and Mr. Church's paper presented that side of the question with a good deal of force. It has taken long experience and a good many minor improvements, both in engines and dynamos, to change the course of engineering work, and even now the question is somewhat unsettled.

The fire insurance question was next in order with Mr. S. E. Barton, the persistent champion of the electric light station insurance, having the subject in charge. He went over it pretty thoroughly; but the strength of the association was being reserved for the alternating current fracas billed for the next morning which proved to be a general Donnybrook Fair, with Mr. T. Carpenter Smith — the steadfast upholder of the wriggling current, wielding the biggest blackthorn. He was followed by Mr. O. B. Shallenberger, who cracked the heads which Mr. Smith had incidentally left unfractured. And from that time on the very mention of alternating current in a convention of the National Electric Light Association has much the same soporific effect that a red rag has on a flock of turkeys.

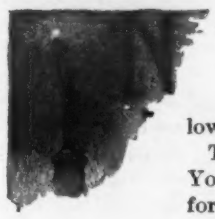


LEO DAFT.

As if this subject were not sufficient to rouse the delegates into unwonted mental and physical activity, the underground question came to the front, and for a wonder there could be found delegates who could find a kind word for mother earth as a guardian for covered wires.

This was the annual election, and the committee on nominations reported: for president, Mr. S. A. Duncan, of Pittsburgh, and for vice-presidents, Mr. E. R. Weeks and Mr. A. J. DeCamp. This slate was duly elected. Then the semi-annual debate on the next place of meeting took place. After a due and suitable amount of wrangling New York was taken as the unanimous choice, and after that the members returned to the fray to cuss and discuss the underground wire situation.

Exhibitors on the warpath, as usual; supply men, ditto, and junketing galore. One of the special points of interest that was visited was the Bentley-Knight electric road operating in the outskirts of Allegheny City, and, of course, the great works of the Westinghouse company were hospitably open for the delegates.

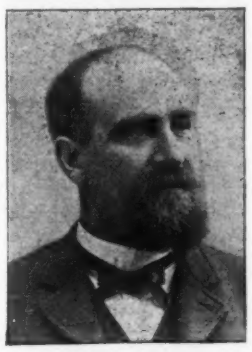


EW YORK, for the second time, saw the National Electric Light Convention on the 29th of August, 1888, and the meeting lasted over the following two days.

The delegates were welcomed to New York by Mayor Hewitt, and after the formal business of opening was over the first paper put in an appearance in the form of a practical and pointed description of the use of crude petroleum as a fuel for electric light plants, by Mr. S. S. Leonard. This communication, which was received with unusual expressions of interest, provoked a very lively and interesting discussion.

Dr. S. S. Wheeler then went into the question of putting the wires in New York underground, which he gave at considerable length, describing the difficulties that had been encountered and overcome in the task of constructing subways in a place so unfavorable, by reason of a multiplicity of underground pipes, as New York.

Apropos of this same topic was a paper on the disruptive discharges that come to disturb the spirit of the managers of underground distribution systems. All this discussion of underground work was particularly pertinent, for the New York electric light companies were just on the point of having a parrot and monkey time with the municipal authorities, and, with ducts at $1,000 per mile per year, managers of New York plants were looking around for any possible way out of their sad plight.



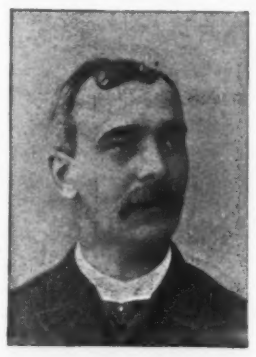
C. R. FABEN, JR.

After this subject was disposed of the constitution of the association was hauled over the coals and the revised form that had been suggested by a previously appointed committee was adopted.

The alternating current again got in its work during the last day of the convention, and the pleasant question of the comparative danger of alternating and direct currents came up to be a thorn in the flesh of electric light men for the next two or three years. The electrical execution law had just then been passed, and the pamphleteers and men with axes to grind were gloating over the opportunities for wrangling given by the new law.

At one of the former meetings the subject of electrical education had come up, but at this time Mr. E. R. Weeks gave an interesting account of the work that had been done among the employés of his own station in electrical self-education.

The motor received its share of attention, and Mr. H. L. Lufkin gave the first of several important papers from his pen on the conditions of motor service in various industries. This paper on the power consumed by motors was really the first one to give a definite idea of the actual demands made on the electric motor by the various light industries.



M. D. LAW.

The exhibits were particularly large and elaborate, and the social entertainments were many. One large party went down to Staten Island as the guests of Mr. Erastus Wiman; the New York Electric Club kept open house, and, at the close of the convention, a couple of hundred delegates took a steamer for Providence to attend one of Eugene Phillips' inimitable clam bakes.

For the next meeting the delegates were to adjourn to the Windy City, where the association had had its origin in 1885.

HICAGO on Feb. 19, 1889, welcomed the delegates to the ninth meeting of the National Electric Light Association with its customary February blizzards.

Prof. J. P. Barrett welcomed the visitors on behalf of the Mayor, and President Duncan then gave an address containing some most interesting figures as to the growth of electric lighting.

It is worth noticing that by February, 1889, there were about 220,000 arc lamps and 2,500,000 incandescents in actual use, and the electric railway that had been looked upon almost with wonder at some of the earlier conventions, was numerous to the extent of about 100.

Committee reports were the order of the day, and chief among them was that of the committee on underground conduits and conductors, which contained a mass of information. Then the excitement commenced. The subject itself was sufficient to provoke discussion, but all the men with axes to grind had them out and simultaneously attempted to grind them, with the result of producing a long and rather profitless wrangle, which led to no results whatsoever, except to make the fellows who did not get their axes ground somewhat sore.

After an indefinite amount of fighting the convention adjourned to the next day, when the executive committee reported resolutions with reference to a permanent home for the association. After wasting some time officers were elected as follows: President, E. R. Weeks, of Kansas City; vice-presidents, A. J. DeCamp, of Philadelphia, and E. A. Maher, of Albany.

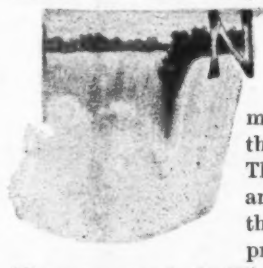
Mr. S. E. Barton turned up with another paper on the insurance aspects of electric lighting. This started a discussion lasting late into the next day's session.

The effect of disruptive discharges in underground cables that had been before former conventions came to the front again and was greeted with a prolonged debate.

Oil as fuel also appeared again in three separate and useful papers. All this went well, but presently a bombshell was exploded in the assembled throng by some one incidentally bringing up the question of municipal lighting. Now, municipal lighting to a member of the National Electric Light Association is gall and wormwood, and the fur began immediately to fly, with indefinite discussion.

The exhibits in the Chicago convention were in the exposition building, and exceeded in size and importance any that had yet been seen on similar occasions.

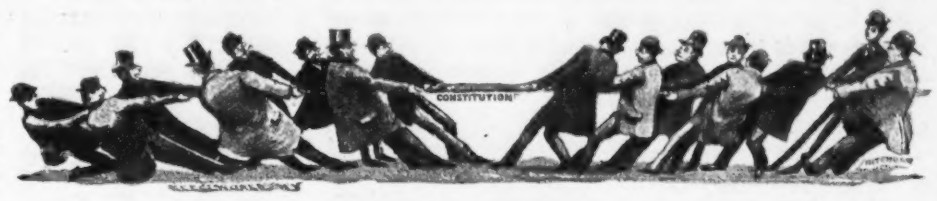
This convention, too, was signalized by a special train carrying the New York members to Chicago. It was a very jolly party that pulled out of New York on the electric special, and with numbers swelled by delegations from Philadelphia and Pittsburgh they went through to Chicago. The train was universally conceded to be the finest ever sent out from New York. It consisted of new vestibule cars lighted throughout by electricity. It was the first of the electric specials that have been a feature of conventions distant from the metropolis.



IAGARA was the next meeting point of the association, and it was only due to skillful management that it did not then terminate its existence by going over the Falls, or something very like it. The meeting convened on August 6, and the delegates were then and there introduced to two great projects; first, the utilization of Niagara; second, the World's Columbian Exposition, which was brought to their notice by a letter from Mayor Grant, of New York, suggesting that the exposition would probably be held in that city, and desiring the co-operation of the president of the Electric Light Association. This instantly stirred up the Chicago delegation, but the turmoil was presently allayed and the regular business went on.

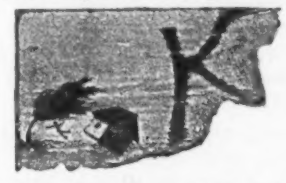
One of the most important papers was that by Mr. M. D. Law on arc light stations, detailing some remarkable results obtained by care in designing. It created considerable discussion, and then came the customary report on electrical insurance questions, which, as usual, provoked a good deal of comment. The next day electrical execution again came forward, with protests of every description. As was to be expected, such a proposition was received by the electric light men with execration.

The electric railway next turned up, first through a proposition to appoint a committee for the purpose of standardizing the voltage to be used on overhead lines. It was felt that there was a necessity for uniform practice in this respect, and that the influence of the association should be thrown in favor of standardization. Electric traction by storage batteries was taken up, with an accompanying description of the results that had been reached in New York. Then electrical measuring instruments received consideration, and afterward the electric railway was again discussed in a comprehensive paper by Mr. G. W. Mansfield. It is worth noting that whereas at the time of the foundation of the National Electric Light Association in 1885 there were but three electric railways in the country, at the time of this convention, less than five years afterward, 109 were in operation or under construction. The electrical transmission of power received consideration in a careful paper by Prof. E. P. Roberts. This terminated the regular business of the association. But when the question of the place for the next convention was raised there was trouble. It



A CONSTITUTIONAL DIFFICULTY.

was between the central station men proper and the supply contingent, and they very nearly managed to wring the neck of the constitution and upset things generally. The real question at issue was the policy of the association, whether it was to constitute a general electrical body, or was to assume the functions of a central station trades union for the mutual benefit of the members. The central station men finally got the upper hand, and the convention adjourned amid blue flame and the smell of sulphur, after selecting Kansas City for the next meeting.



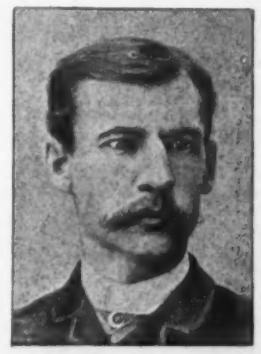
ANSAS CITY saw the most successful and important meeting of the National Electric Light Association that had as yet been held. The meeting began Feb. 11, and another electric special was sent out from New York bearing the Eastern delegation, which stopped on the way at Chicago and was greeted with an elaborate reception by the Chicago Electric Club. Taking the Chicago delegation aboard the train then rushed on to Kansas City, and by the morning of the 11th all hands were there.

The first day of the convention was devoted to the opening of the meeting, the formal address of welcome by the Mayor of the city and the president's annual address. The next morning the convention went to work, and, after committee reports, the one on electrical insurance arousing an especially protracted discussion, the central station was taken up in earnest, and four consecutive papers dealing with the subject were read, two of them dealing with station construction and two with the generation of power by boilers and engines. Mr. T. Carpenter Smith then came to the front with a system of central station accounts that was received with general appreciation.

JAMES I. AYER.

The next important paper was then given by Prof. Elihu Thomson on safety devices in electrical installations. It was an especially refreshing discussion of the problem for the reason that there was no attempt made to crawl out of any difficulties. They were squarely admitted and the remedies promptly suggested. In the face of the wild statements that had been occasioned by the discussions of electrical executions during the previous year, this calm annunciation of fact was particularly appropriate.

The last important paper was one by Mr. F. J. Sprague on the application of electricity to street railways that really marks an epoch in electrical traction, for after reviewing a large number of subjects of interest Mr. Sprague proceeded deliberately to attack the question of the application of electricity to general railroading. It was the first to appear of a series of papers by various authors treating the same topic that followed within a few months.

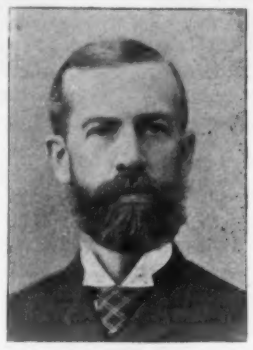


FRANK J. SPRAGUE.

The committee reports and similar matters were then taken in hand. Electrical execution provoked the usual amount of wrangling, and finally, on Feb. 14, the association adjourned after a most successful meeting, at which the papers were of unusual importance and the exhibits most elaborate.

At this Kansas City convention the officers elected were: President, M. J. Perry, of Providence; vice-presidents, E. W. Maher, of Albany, and C. L. Edgar, of Boston.

CAPE MAY was selected, as is charitably supposed, in a period of temporary mental aberration, for the next summer convention of the association, and those who gathered there during the hot weather in the latter part of August, 1890, still remember with inward maledictions their unhappy experience. Air would have been charged for at rates that would have staggered a gas company if it had been practicable to fence it in and sell it by the cubic foot. Nevertheless, the convention was not uninteresting, and was well attended.



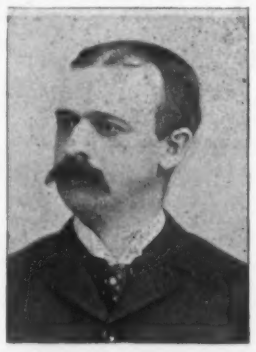
H. H. Fairbanks.

Aug. 19 the meeting was opened and after the formal exercises there were a number of subsidiary papers and committee reports. The next day Mr. George S. Bowen, one of the founders of the association, visited the convention and was enthusiastically received. Then Mr. Francisco presented a paper on municipal lighting that delighted the members by the vigorous manner in which municipal control, the bugaboo of central station men, was treated. The discussion was prolonged and lively, and ended in the adoption of a proposition to publish Mr. Francisco's paper and scatter it broadcast throughout the country.

Then came a little skirmish on the Columbian Exposition question. Several axes had been brought down to grind, and their respective proprietors eventually succeeded in blocking each other's way most effectively. Aside from Mr. Francisco's paper, perhaps the most important one of the meeting was a discussion of the electric motor service from the standpoint of a central station man, by Mr. H. L. Lufkin, the question at issue being the proper basis for determining the rates to be charged for electric motor service. It was on the same lines as Mr. Lufkin's similar paper at the former convention.

"What are the Wild Waves Saying?"

Then came a pair of papers on the generation of power by steam engines, one by Mr. H. M. Swetland, and a second by Mr. Williams, the well known engine designer. At the next session of the association there was the report of the committee on the revision of the constitution, through Mr. Francisco. No sooner had he taken his seat than the fur began to fly, and such a skirmish has rarely been seen, except, possibly, at a ward primary. Finally, however, the irate members became somewhat calmed down, and the association settled down to business. The point at issue was much the same as that at the Niagara Falls convention, involving the policy of the association, and eventually the central station men, who had acquired the supremacy at Niagara, by providing for executive sessions from which associate members should be excluded. The last session was, for the most part, taken up with committee reports of special importance only to members, and then the delegates took flight, shaking the dust off their feet against Cape May, and blowing the dust out of their throats in uncomplimentary comments as to the selection of such a place for such a meeting.



E. W. Rollins.

It was decided that the next meeting should be held in Providence, the home of President Perry, where the association would be properly taken care of.

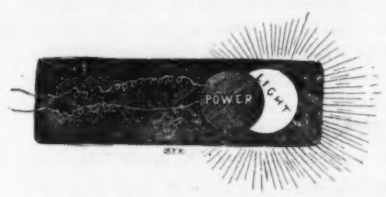
PROVIDENCE, Perry and Phillips made a triliteral combination stronger than that devised by the Rev. Dr. Burchard. On Feb. 17, 1891, the largest crowd of delegates that had ever attended an electric light convention turned up in Providence and took bodily possession of the Narragansett Hotel. After a preliminary address of welcome by the Mayor of Providence, President Perry paid his respects to the association in a very neat presidential address that was most cordially received. Then the secretary took occasion to read a number of letters extending the hospitalities of various Providence organizations to the assembled delegates.

A few committee reports over, the first paper was taken in hand on the subject of electric lighting as applied to railroad service, more especially to the lighting of yards and stations—a problem involving some special constructions. After this session many of the members adjourned to the fine station of the Narragansett Electric Lighting Company to inspect that recently completed plant. During the second session there were several reports and a clever paper on the distribution of steam from central stations.

Happy as a Clam.

The next day was set apart as pioneers' day and proved a most interesting occasion. It was devoted to reminiscences of the early days of electrical industry, and the principal speakers were Prof. Elihu Thomson, Thos. D. Lockwood, J. H. Herrick, F. J. Sprague and Prof. J. Elfreth Watkins. Dr. Norvin Green, the venerable president of the Western Union Telegraph Company, Prof. Alexander Graham Bell and Cyrus W. Field sent letters of regret.

The personal reminiscences were of great interest, and many a striking point about the early history of the art was brought out in the afternoon session. Prof. Elihu Thomson read a brilliant paper on the electric arc and its use in lighting, giving a vast amount of valuable information regarding the modern theory and practice of arc work. After a few committee reports the meeting adjourned until Thursday morning, when a paper on the remarkable Ferranti station near London was read. Mr. T. Carpenter Smith got in his work on alternating currents in a very interesting fashion. One of the most important reports was that of the committee on data to which special interest was given by a discussion on economy in generation of power, a paper presented by Mr. Swetland, giving the results obtained by over 100 companies, nearly all of them electric.



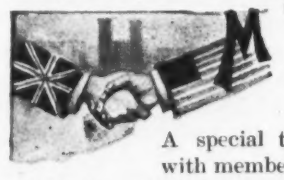
A Possible Coming Eclipse.

Chas. R. Huntley.

In the afternoon the meeting convened in executive session, and the following officers were elected: President, C. R. Huntley, of Buffalo vice-presidents, James I. Ayer, of St. Louis, and M. J. Francisco, of Rutland.

A vigorous effort was made by our Canadian friends to secure the next meeting of the association, and so cordial was their invitation that it was decided to migrate to Montreal, and there hold the succeeding summer meeting.

The social festivities at Providence were most alluring. President Perry gave a reception which was the centre of attraction to all the delegates, and on the evening of the following day Phillips—he of clambake fame—gave, in the new factory of the American Electrical Works, a ball and banquet that was a brilliant success. The exhibits in the hall near the hotel had acquired almost the character of a young electrical exposition.



MONTREAL was comparatively distant, and everybody was starting a day ahead of time. Sunday, Sept. 6, 1891, was the grand gathering day. A special train from New York loaded with members pulled out of the Grand Central Station a little late, and nothing exciting happened until near Manchester, Vt., the engine broke down. Mr. T. Carpenter Smith was promptly on hand with a pry bar, and eventually got the train started for Montreal again. At St. John a Montreal delegation, headed by two bagpipers discoursing unearthly sounds, boarded the train and escorted the delegates to Montreal. Then there were lively times in the cars, and two or three of the delegates reached Montreal bewailing the fate of their new silk hats.

The Windsor Hotel was the headquarters and proved to be most admirably adapted for the purpose. Too much cannot be said of the enthusiasm with which our Canadian friends welcomed the association and the hearty hospitality of Prof. Bovey, Sir William Dawson, Sir Donald Smith and Mr. F. R. Redpath will be long remembered.

The committee work was specially active, and a number of interesting reports were read, chief among them being that of the committee on safe wiring rules, which presented a set of carefully worked out specifications that will be of great future value in the art.

Of papers there were several of much importance. The paper read by Mr. T. Carpenter Smith on alternating current stations at the previous convention was discussed very freely, and a paper on central stations operated by water-power attracted a good deal of attention, as did Mr. H. Ward Leonard's proposition for a composite station to use both alternating and direct currents on the same network. The discussion on this took an exceedingly lively turn.

The Montreal Exhibition Hall.

H. Ward Leonard.

The electric railway assumed a prominent position, and two papers by Capt. Eugene Griffin and Mr. C. J. Field dealt respectively with the history and present practice of the subject.

Perhaps the most interesting of all, however, was Mr. J. I. Ayer's valuable account of methods used in his own great station at St. Louis for securing the best results from an arc lighting plant.

At the final executive session Buffalo was selected as the place of the next convention, and then, the formal business being over, the delegates were at liberty to attend to social events, the most important of which was the banquet at which Lord Stanley, Governor-General of Canada, was present. The after-dinner speeches were of a truly international character, and the electrical press, represented by Mr. G. M. Phelps, came to the front with characteristic modesty.

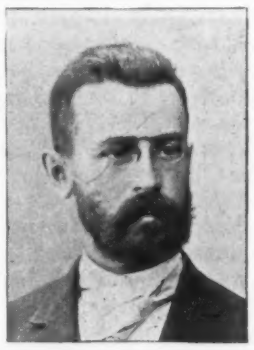
The "Electrical Special."

It was with regret that the members of the association left the hospitable city across the border and turned homeward.

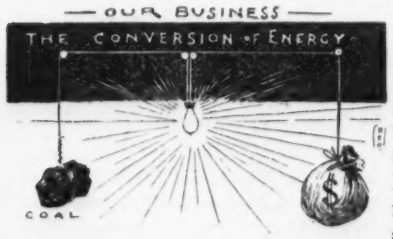
The exhibits at Montreal took the form of a general electrical exposition, which proved very successful, thanks to the efficient management of Gen. Barney and the cordial co-operation of the Canadian electricians.

BUFFALO now greets us, and the present convention bids fair to be the most businesslike that the National Electric Light Association has ever seen, such has been the growth of the past few years, and the little gathering at Chicago has grown to be the representative organization of the most progressive and active central station men in this electrically lighted country.

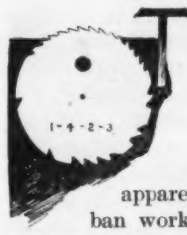
The programme is a most interesting one, intended to take into consideration every part of an electrical station, even in its business relations—from the coal pile to the dividend. Three sessions a day are to be held, allowing the presentation of a large amount of important matter. The evening devoted to the discussion of the long distance transmission of power is a most valuable feature of the meeting. The electric motor and the electric railway have been watched by the National Electric Light Association with the keenest interest all through the period of their swift development. But now is the beginning of a new era, the epoch of colossal applications of electric motive power, and every central station manager may well consider most attentively the prospect of a vanished coal pile and his power drawn from a waterfall 10, 20 or even 50 miles away. The gigantic plans for the utilization of the vast power of Niagara are now nearing a realization, and such an example is enough to arouse the greatest enthusiasm. And so this meeting at Buffalo may well be long remembered as ushering in a period of fresh activity, swift and far-reaching changes and of magnificent results. It is the desire of every member of the organization that the brilliant record made by the National Electric Light Association may be an indication of its future.



Carl Hering.



Individual Arc Light and Motor Cut-Outs.



THE problem constantly presented to the managers and superintendents of the average electric light plant is how to organize their circuits and service so as to save unremunerative wiring and unpaid for current. In the great cities this difficulty is not apparent, except in connection with suburban work and in certain special classes of public business; for the volume of custom offered and its concentrated nature permit the economical use of separate circuits for each class of lamps and motors. But in the vast majority of cases the managers have either to content themselves with a partial use of their circuits if they supply one for each class of work, or else furnish an amount of unpaid for current which in the aggregate represents a serious loss of income. Any method which will permit the central station men to control the service of individual lamps and motors, or groups of these, in exact accordance with their contract requirements would, if practicable, prove of considerable interest to operators of plants, and it is with a view to satisfying the curiosity of our readers in a widely advertised scheme of this kind that we present the accompanying illustration and diagram.

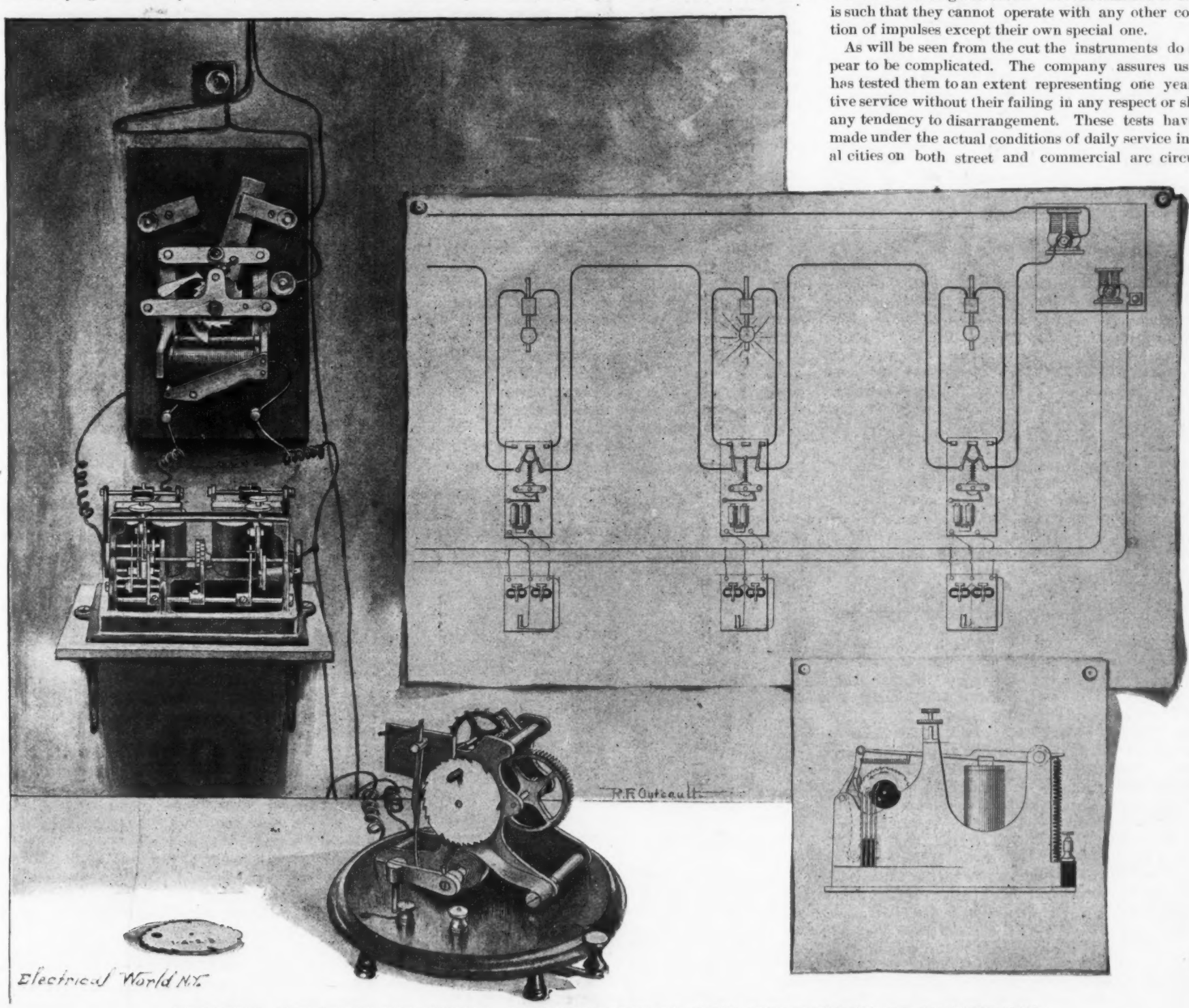
The method shown is that of the Electric Secret Service Company, 45 Broadway, this city. For several months past the company has announced the completion of a system which professes to place the absolute control of every light and motor in the hands of the central station and permit the cutting in or out of any one of these, or as many as are wished, from a given circuit without affecting the others on the same wires. From motives of its own convenience the company has withheld, until now, publishing the details of its plan, but these being now satisfactorily completed THE ELECTRICAL WORLD has been invited to examine the operation of the instruments and gives the results herewith.

The keynote of the whole operation is the application of the principle of the combination lock to electric light circuits. The Electric Secret Service Company makes a specialty of supplying to the railroad and telegraph companies what it calls electric locks or selectors, so constructed that they will respond only to a fixed combination of impulses sent from a central or transmitting station. A dozen such instruments may be inserted in a single telegraph line, and if they are furnished with separate combinations, only that one will operate with which the transmitted impulses correspond. A full description of these telegraph instruments was given in THE ELECTRICAL WORLD of July 11, 1891. Adapting the same idea to the control of lamps and motors, the company has designed machines which it claims will handle as satisfactorily the heavier current of dynamos as its other type of instruments does that of telegraph circuits. For electric lighting purposes the system consists of a transmitter at the central station and a selector or lock working a specially constructed switch at each arc lamp or motor, or group of these, which it is desired to cut in and out at a given time. Our illustration explains to a great extent the method of operation. The transmitter is located at the central station. It may be of any convenient type so long as it is furnished with discs cut to correspond with the selectors or locks on the circuit. For a circuit operating four classes of lamps there will be four discs, say (a) 2-1-4-2, (b) 1-1-3-1, (c) 2-3-1-2, and (d) 1-4-3-2. These would represent the four classes, and each lamp or motor, or group, to be lighted or extinguished at the same time would have locks or selectors corresponding in combination with one of the discs. It will be understood that the number of these may be varied at pleasure, but that all of the lamps or motors to which the same combination is assigned will be cut in or cut out at one time. The instrument at the point of application consists of the lock or selector as illustrated, all of which are alike except in respect of the combinations cut on the wheel. To this selector is attached a dead-loop switch so constructed that it will only operate when the selector attached to it has received the particular series of impulses destined for it. The instruments may be worked either by a reduced current taken from the main dynamo, or, preferably, by a small two horse power dynamo in the central station. One form of wiring is shown in our diagram, the size used being No. 12. Another form provides for the use of only a single wire to operate the selectors and switches, and it is contemplated to arrange the wiring to suit individual stations.

If we take, as the simplest case, a circuit upon which it is desired to carry 9 o'clock, 10 o'clock and midnight lights together, the transmitter at the central station would be furnished with three discs, each bearing a separate combination, and the locks or selectors would have their wheels cut to correspond with whichever disc operated their class of lights. At 9 o'clock the central station man would attach the disc for that class and set the transmitter in motion by "pressing the button." That particular combination, say 2-1-4-2, would pass over the locking circuit without working any of the locks except those bearing the same combination. These, however, would revolve in unison with the impulses from the transmitter, and at the end of the combination would transfer to the switch the succeeding impulses cut upon the transmitting disc. These latter impulses rotate the cam of the switch and throw it with a quick snap at a given dot. The whole operation consumes only a few seconds. The 10 o'clock lights would be extinguished by substituting another disc, corresponding with the combination on the 10 o'clock locks, and repeating the operation as described. The midnight locks would be operated in the same way. The switches are so adjusted that they cut out on one rotation of the disc and cut in on the next, their action being alternating. Consequently, to light the lamps exactly the same course is followed as to extinguish them. The mechanism of the locks is such that they cannot operate with any other combination of impulses except their own special one.

As will be seen from the cut the instruments do not appear to be complicated. The company assures us that it has tested them to an extent representing one year of active service without their failing in any respect or showing any tendency to disarrangement. These tests have been made under the actual conditions of daily service in several cities on both street and commercial arc circuits, on lines carrying respectively 36 and 43 Fort Wayne 2,000 c. p. lamps, all burning at the time of the tests. A large correspondence has been received from all over the United States and many foreign countries concerning the system and many special problems of wiring and other requirements presented for consideration. The company claims that it is able to adapt its system to the varying needs of incandescent, arc and power circuits, and that it can in most cases so organize the service to be done by its locks as to reduce the number of these required to a minimum and thus effect economies in construction, operation and mainenance.

This application to electric light and power appliances of the principle of individual selection is primarily the invention of Mr. Robb MacKie, the engineer of the Consolidated Electric Light companies of Cincinnati. In their present simplified form the instruments are the outcome of a long series of experiments conducted by Mr. S. S. Bogart, the chief electrician and general agent of the Electric Secret Service Company. The company proposes to exhibit its system in practical operation at Buffalo during the session of the Electric Light Convention.



INDIVIDUAL ARC LIGHT AND MOTOR CUT-OUTS.—GENERAL VIEW AND DIAGRAMS OF CONNECTIONS.

Notes on Electromagnetic Machinery.—II.*

BY WM. S. ALDRICH, M. E.

The electromagnetic kinematic chain may be developed by reference to Figs. 11 and 12. Multipolar types are preferably here used. If the arm L, connecting the two fields in Fig. 11, be fixed, the combination may be used as a dyna motor. And by driving armature Q as a dynamo, by power, or by a motor secured to the arm L, armature P will operate as a motor, turning at a certain definite and predetermined speed with respect to Q. Should the armature P be slowed down by a fixed brake or clutching device, and the armature Q rotated as before, there will be a rotation given to the field C_1 of P in the opposite direction to which the armature P is turning, in order that the lines of force across P may continue to be cut at the same rate as before; that is, when the field was fixed and the armature was free to revolve. If armature P be wholly stopped, its field C_1 will turn around, carrying the arm L and its appur-

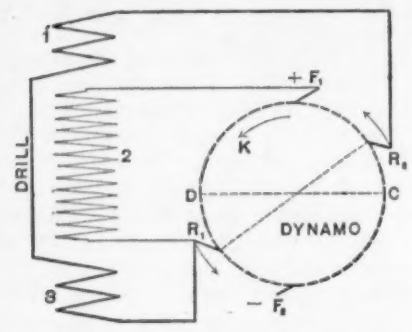


Fig. 14.—Van Depoele Reciprocating Drill.

tenances, at the same speed at which the armature was formerly turning, but in the opposite direction. If, on the other hand, the speed of the armature P be increased by applying external power, then, to cut the lines of force at the designed rate, the field C_1 of P, and so the arm L, will have to turn around in the same direction as the armature P. The armature and its field form an electromagnetic turning pair of elements; in the first case above acting as a motor-turning pair, and in the second case as a dynamo turning pair of electromagnetic elements. The placing of two armatures, P and Q, in the same magnetic circuit makes it an electromagnetic connecting link between them; while, if placed simply in the same electric circuit, they form a combination of elements electrically linked. The elcctromagnetic chain is then built up of electromagnetic links, which connect electromagnetic pairs of elements. Two or more armatures may therefore be electromagnetically arranged in series or parallel, or any of the usual modifications and combinations of these groupings. And, from the kinematic standpoint, two or more armatures, with their fields, may be kinematically arranged as an electromagnetic kinematic chain; the mechanical equivalents of this combination may be seen in belt kinematic chains, wheel kinematic chains, and crank (linkage) kinematic chains. In general, then, an electromagnetic kinematic chain may be considered as a combination of electromagnetic connecting links, so connecting pairs of electromagnetic elements that all parts of the chain have determinate motions; such motions being determined by the form of the elements carried by the links, and independent of the application of external force when considered merely as a change in position. Fig. 12 shows a simple ideal electromagnetic chain of three links. Whether the armature P is held fixed or is rotated, certain definite motions may be obtained from the armatures Q and R in either case. Fixing the centres of armatures Q and R (the same as fixing the rigid connecting link between P and Q of Fig. 11) would lock this three-link chain, so far as any motion of the centre of P in space would be concerned, and the armature P would then revolve as about a fixed centre. Kinematic chains of four or more electromagnetic links admit of a greater variety of relative and constrained motions; and, as in any case, become convertible into a mechanism by fixing one link. The extreme flexibility of the electromagnetic connection admits of many combinations of the simple electromagnetic pairs for producing rotation, translation or helical motion.

Some industrial applications of electromagnetic machinery have been taken from among the many drills operated directly or indirectly by these means. Drilling operations admit of peculiarly compact and portable machines, and ready adaptation of either rotary or reciprocating motions produced and controlled by electromagnetic means.

The Rowan electric drilling machine, with an electromagnetic clamping device, is shown in Fig. 13.† The main frame, M F, is easily placed in position, and electromagnetically clamped by the holding-down magnets H M to the iron or steel plates to be drilled. The drill is then operated through the usual mechanism for increasing or decreasing the speed, from an electric motor, E M, mounted on the main frame, M F. The feed is by hand, through the feed-gear F G. The drill can be moved over the work, along the guides, G G, by the transverse shaft, T Sh. The Willet's portable electric drill cuts holes two and three-eighths inches diameter through two and one-half inch steel armor-plates, in position on deck, in twenty-one min-

*A paper read before the Electrical Section, Franklin Institute.
† The Electrical World, 1887, June 25, p. 301.

utes. This work formerly required two men, working a half-day each.

The Van Depoele reciprocating electromagnetic mining drill is a good example of the direct application of a controlled reciprocating movement. The length of stroke is about five and one-half inches, and at every stroke the drill turns automatically one-eighth of a revolution about its axis, so that the drilled hole is truly cylindrical. The forward advance is made by a feeding screw operated by hand. About 2 h. p. is absorbed in drilling holes from one and one-half inches to two inches diameter. In experiments at Frankfort 1.4 inch diameter holes were drilled per minute, in gypsum blocks, to a depth of 7.9 inches with water and 4.7 inches without water. In Odenwald granite a hole 1.7 inches diameter and 15¾ inches deep was drilled in ten minutes.* Two thick wire outer coils, 1 and 3, with a thin wire inner coil, 2, are wound, side by side, and secured to an iron casing, completely closing in the magnetic circuit, and so forming an efficient iron-clad construction. The drill spindle is attached to an iron core introduced into the coils. The coils 1 and 3 are oppositely wound, so that they are equally and oppositely polarized and connected up in series with the rotating brushes R and R_2 of the generating dynamo, or of the distributing motor dynamo; these coils are therefore traversed by an alternating current. The coil 2 is connected at one end to the fixed brush F_2 and at the other end to the junction of coil 3 with the rotating brush R_1; it is therefore traversed by a pulsating current, and exerts the chief magnetizing effect upon the reciprocating iron core, with a constant polarity. Speaking kinematically of this combination of electromagnetic elements, forming an electromagnetic kinematic chain composed of reciprocating pairs, it is seen that the motion of the iron core is determined to a definite extent by the constant direction (polarity) and variable energizing coil 2, in combination with the variable direction (alternating polarity) and variable energizing coils 1 and 3. Moreover, the iron core, as an electromagnetic link, under the influences of its electromagnetic pairing with the energizing coils, has its motion completely constrained. This electromagnetic constrainment of motion of the iron core link of the chain constitutes the combination a true electromagnetic mechanism: and when the electromagnetic forces of nature can be compelled to do work through and by this electromagnetic mechanism we have a pure electromagnetic machine. It is to be especially noted that the enveloping forms of the pairs of electromagnetic elements are such that there is no contact of these elements, while in mechanically connected pairs of elements the contact of the enveloping forms is a necessary condition to the constrainment of motion. It is,

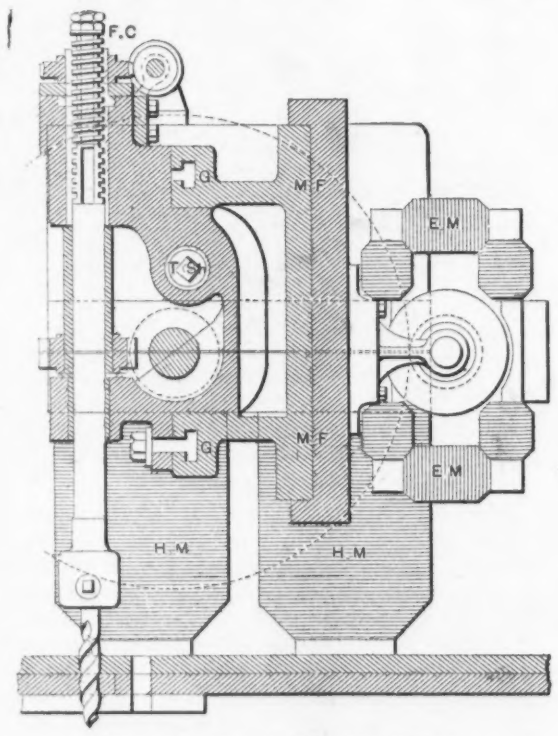


Fig. 13.—Rowan Electric Drill.

therefore, possible, in a pure electromagnetic mechanism, to have constrained motion without the contact of material elements. Oftentimes practical considerations preclude the possibility of using electromagnetically constrained motion, and it is found best to constrain the motion mechanically by the pairing of material elements, such as the cylindrical turning pair of elements in the dynamo or motor, and the cylindrical sliding pair of elements guiding the drill spindle in the Van Depoele reciprocating drill.

Direct and indirect electromagnetic machines are those in which the transmission of energy, through an electromagnetic mechanism, is of a direct or of an indirect character, according to whether the electromagnetic forces act directly at the point of application (as in the Van Depoele mechanism), or indirectly through the intervention of other mechanism, such as a train of wheel-work, as in the Rowan machine. The indirect transmission is, in fact, through electromagnetically actuated mechanisms or devices, which are of themselves essentially of another system, or which call into operation other forces of nature than the electromagnetic forces; such as the wheel-train of the Rowan machine, transmitting the energy by purely mechanical means, from the electromagnetic mechanism of the electric motor to the drill-spindle. It is to be remarked that the self-fixing or clamping device of the Rowan machine, acting as it does by the application of electromagnetic traction, is an example of a locked kinematic chain, and that in this particular case such a locking, clutching or clamping action is brought about by the contact of material elements in the magnetic circuit. There are, however, examples of such a locking action with no contact of the material elements of the magnetic circuit, as may be seen in the Faraday copper disc type of dynamo, used as a true electromagnetic clutch or brake.

The diagram of the cycle of operations of the electromagnetic mechanism of the Van Depoele machine will be presented in the next paper.

* *The Electrician* (London), vol. XXVIII., Nov. 6, 1891, p. 10.

Alternating Sparking Distances.

The following tests of the sparking distances of 20,000 alternating volts between two balls, a ball and a sharp point, and two sharp points, made by Mr. Ferranti, are published in the current number of *The Electrician*, of Lon-

Alternating Sparking Distances.

don. The dimensions of the balls and points are given in the accompanying sketch.

2 Balls 1/16 inch diameter (about 18 millimetres).

Distance apart.	Result.	Remarks.
Inches.		
¼	Over directly.	
5/16	" "	
3/8	Over after 2 minutes.	
7/16	Not over.	Went over when the 2,400 V switch was put off *sharp*.
½	" "	" " " "
9/16	" "	When switch was put off *slowly*.
5/8	" "	" " "
11/16	" "	
¾		

Ball and Point.

Inches.		
3/16	Over directly.	
¼	" "	
5/16	" "	
3/8	" "	
7/16	" "	Visible discharge before going over
½	Over.	" " " "
9/16	"	" " "
5/8	"	" " "
11/16	"	" " "
1	"	" " "
1 1/16	"	" " "
1⅛	Over after 1 minute.	Visible discharge from point, but
1¼	Not over.	did not go over after two minutes.

Two Points.

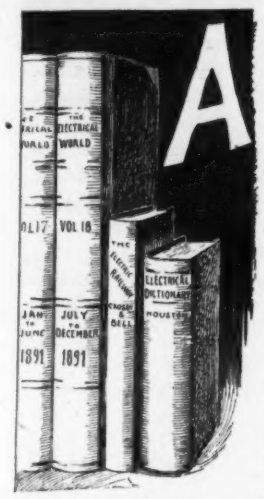
Inches.		
1	Over directly.	Discharged as above.
1 1/16	Not over.	Discharge but not over until 2,400 V switch was put off (on 2 minutes).
1⅛	" "	" " " "
1 3/16	" "	" " "
1¼	" "	No discharge, but went over when switch was put off.
1 5/16	" "	" " "
1⅜	" "	Nothing happened.

Inspection of Western Union Headquarters by the New York Electrical Society.

The new operating rooms of the Western Union Telegraph Company were thrown open to the inspection of members of the New York Electrical Society and the American Institute of Electrical Engineers, Wednesday evening, Feb. 17, and a large representation of the membership of both societies was present through an invitation extended them in behalf of the Western Union Telegraph Company, through Vice-President General T. T. Eckert. Mr. Alfred S. Brown, electrical engineer of the company, was present, and welcomed the visitors. He was called upon for a speech, and stated that he had been to sea, and having but just returned from Europe, was not aware that he was down on the invitation which had been extended to the visitors, and, least of all, had intended to make a speech, but supposed that it was expected of him to explain the workings of the apparatus and operating rooms which the visitors were present to inspect. He referred to the improvements which had been made in the main operating room, an illustrated description of which was given in The Electrical World of Jan. 30, 1892, and also to the many general improvements that had been made in the several other operating departments. He concluded his remarks by thanking those who were present for their acceptance of the invitation of the company which he represented, stating that he was very much gratified to see such a large representation of the members of the societies, which was an indication of the interest taken in the efforts of the Western Union Telegraph Company to fit up the finest operating rooms in this country, and that he and other representatives of the company would be pleased to take the visitors in hand and show them through the rooms and explain the working of any of the apparatus which was not understood, although he thought little explanation would be necessary to so many electricians and electrical experts.

A Practical Electrical Library and Reading Room for Central Stations.

BY E. R. WEEKS.



ALTHOUGH electric light has been a commercial fact for more than a decade, there is still a lack of adequate information in regard to its safe, satisfactory and economic production. This is in a great measure due to the fact that so many employers began by running their plants with cheap labor, seeming rather to deprecate the employment of any means whereby their men might be rendered more capable of properly handling their new and short lived machinery. Instead of recognizing from the first that costly apparatus could yield its best results only when operated with a good degree of intelligence; that the required skill must necessarily come from ignorant experiments on this apparatus; instead of employing all means within their power to create in the shortest possible time a corps of intelligent workmen, they proceeded upon the supposition that any one could run a central station. The result is many blunders, and quantities of apparatus consigned to the scrap pile.

The far sighted policy would have been to recognize immediately that the school for the workman must be the station; there he must acquire mechanical skill, there he should acquire the information that the schools were not prepared to give, that they could not be expected to give in time to materially assist the new work. Every book put into the hands of the employés then would have meant a return of many times its value in more intelligent handling of machinery; every reading room would have meant a more progressive corps of workmen personally interested in the success of employers.

It is probable that the schools will never be able to fully equip men for the field of practical electric work. The mechanical must go hand in hand with the theoretical to a degree far greater than is possible in any laboratory plant, however extensive. Therefore the employer will always find it to his interest to furnish his workmen every possible opportunity for advancement. If running expenses are to be reduced, and dividends earned, let every workman know that the path to promotion is through the station by way of the reading room and library provided by his employers. A few books stored in some corner spared because of its inconvenience, will accomplish little. The men to be benefited must be attracted to the work of self education by making the reading room a pleasant place.

A commodious room, well lighted, heated and ventilated should be provided with all the conveniences designed to render the pursuit of knowledge easy. It should have walls finished in hard wood or tile which can be kept in good condition. All the furniture should be neat, durable and comfortable. Large substantial tables covered with oil cloth, furnished with stationary ink-stands and provided with writing material are an important feature, and there should also be reading desks with the most improved form of journal racks on which should be constantly on file the technical journals. These racks should be so arranged that the files can be taken down if desired, but should hold the papers so securely as to keep them intact for future shelf volumes. Dictionaries, general and technical, should be provided with the most convenient stands procurable, and should be so placed as to induce the men to use them constantly. Even those most accustomed to an unabridged dictionary find it a formidable instrument of knowledge when he comes to utilize it.

A CORNER LIBRARY.

Counterparts of the great pioneers and inventors in the fields of science and mechanics should hang upon the walls, and their biographies, in a popular style, should be upon the book shelves. A large blackboard with suitable appliances will be a valuable aid to the men. On it they can elucidate points that are a puzzle on the printed page; and in discussions, ideas can frequently be more clearly and fully conveyed even in the roughest drawings, than by a tongue unused to details and logical expression. If the reading room is to be used as a place of meeting for a mutual improvement society, the board is indispensable, and will be found a valuable aid in dispelling the illusion of employés that they are parting with something of commercial value when they give to fellow workmen the results of their own experience.

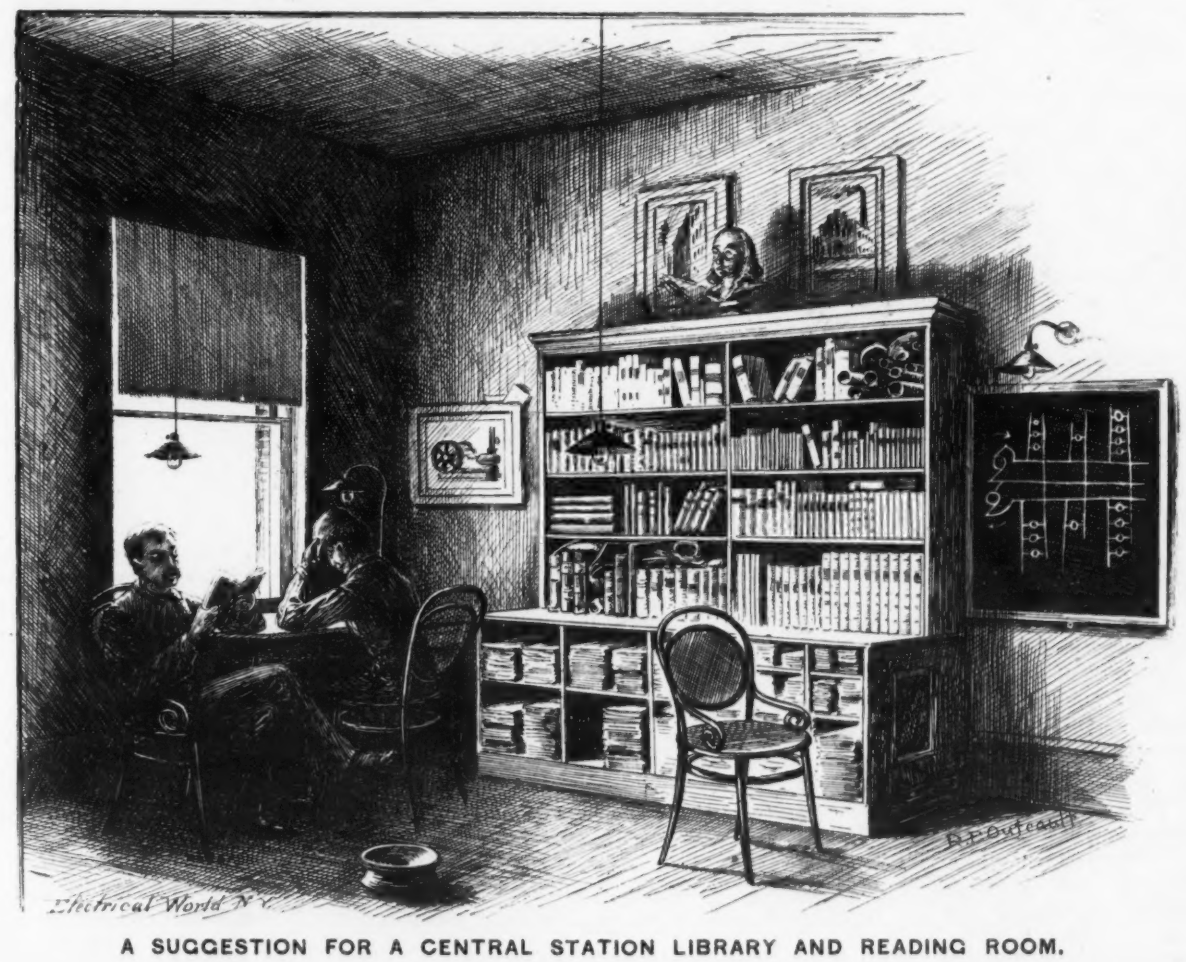
The most satisfactory book cases have glass doors with lock and key. They should be in charge of the librarian, whose office, combined with that of telephone man, would call for little additional expense. The library should contain at least 25 books; six times that number would make a good working library for any central station.

As many texts are got up in a style and nomenclature entirely beyond the taste and reading ability of the ordinary dynamo, lamp and line man, the selection of books should be based on two considerations, *i. e.*, What are the best works? Are they adapted to the needs of men unaccustomed to close study? As individual judgment differs so widely in the composition of a library list, such lists are usually of little value. Nor would the space allotted to this article admit of a complete enumeration of all the books that might be chosen. Some of the departments to be covered are too well known and too fully represented to need specification. The opinion of workmen, however, may be of some value in choosing from the newer field of electrical literature. Several years experience in the library of one of the oldest central stations has shown that among the works in constant use by the men are Thomson's "Elementary Lessons in Electricity and Magnetism," Fleming's "Short Lectures to Electrical Artisans," Urbanitzky's "Electricity in the Service of Man," Kimball's "The Dynamo, How It is Made and How to Use It," Walker's "Electricity in Our Homes and Workshops," Swinburne's "Practical Electrical Units," Lockwood's "Electrical Measurements and the Galvanometer," Martin and Wetzler's "The Electric Motor," Sprague's "Electricity, Its Theory, Sources and Applications," Thomson's "Dynamo-Electric Machinery," Kapp's "Electric Transmission of Energy," and Hering's "Principles of Dynamo-Electric Machines."

Among the necessary books of reference are an unabridged English dictionary, Prof. Houston's "Dictionary of Electrical Words, Terms and Phrases," and some dictionary of mechanics, such as "Appleton's Cyclopædia of Applied Mechanics."

In the field of electric work inventions and improvements follow each other so rapidly that no books, however exhaustive, can take the place of journals and magazines. A goodly number of both foreign and domestic periodicals representing the departments of steam, electricity and mechanics, and the proceedings of the engineering societies and associations should be found in every reading room. The large page journals are especially valuable as affording space for full and clear illustration of new machinery and devices. The importance of such illustrations in technical papers has not been fully appreciated either by public or publishers. Many able articles fall far short of the limits of their usefulness because they are printed without them; to the man unaccustomed to close study they serve as the clearest possible elucidation of difficult text.

The interests of employer and employé are largely identical, and in times like the present it behooves the employer to give proof that he so considers them. He can do this in no better way than by establishing a reading room upon a plan similar to that above indicated, which has already proved its practical working value.



A SUGGESTION FOR A CENTRAL STATION LIBRARY AND READING ROOM.

A New Hotel Fire Alarm System.

A new fire alarm system for use in hotels consists of electric bells having gongs of from 6 to 10 inches to suit the requirements of the building. The gongs are mounted on a polished base, having a box (under lock) attached for holding two cells of dry battery and an automatic drop. The drops are connected in series to their respective boxes in the halls and pushes located in the office. This fire alarm system has no connection whatever with the working of the annunciator, and does not in any way interfere with the working of the combination return call bells, located in the rooms. Upon pressing the fire alarm buttons the drops in the various boxes in the series, or floor, operate and close the local circuit to their respective bells and batteries. Each bell having its own battery is entirely independent of any other bell. The bells will continue to ring until reset. In each hall or designated place are located small alarm boxes containing a push button.

How the Association May Be Made More Beneficial to Central Station Men.

The relatively small representation of central station men in the National Electric Light Association has seemed to many to indicate either that the managers did not consider the advantages of an active membership sufficient to warrant the expense thus incurred, or that an adequate presentation of the benefits to be secured by a connection with such an organization had never been made to those most likely to appreciate it. Whatever may have been the cause of this state of affairs, it has long been recognized that the active membership of the association should be much larger than it is, and as a remedy the present officers have been striving to make the meetings of the association as thoroughly practical as possible, and to bring to the notice of central station managers the fact that the proceedings would be of especial interest to them, and of very great assistance to them in the conduct of their business.

Central station men, whether members or non-members of the association, who have considered this question will be interested in the opinions of some prominent members who have indicated a few of the ways in which they consider that the association may be made more beneficial to central station men.

Mr. H. H. Fairbanks, of the Worcester (Mass.) Electric Light Company, says upon this subject:

"In my opinion it would be better to have but one convention a year, to be held in February, as that seems to be a month which best accommodates the central station men. The association should, I think, meet one year in New York and the next in Chicago, making those two cities the permanent meeting places and alternate between them.

"All the papers which are to be read or discussed before each convention ought to be printed, and put into such form that each member attending the convention shall, upon registering with the secretary, receive them, so that they will be able to see, at the earliest moment, what is going to come before the convention, and can then be prepared to take part in the discussion of any or all the subjects to be brought up. It will not then be necessary to have each paper read before the convention, and the discussion can be commenced at once, thus saving considerable time.

"It would also be better, I think, to have but one session

a day, as early as possible, continuing until one or two o'clock. This leaves the latter part of the day for social intercourse, or any entertainment that may be offered.

"I find that it is a general impression that the meetings of the association are held more with the view of having a good time than to transact business. While I know this is not the fact, I think it is largely due to the custom of holding the meetings in different cities, whereby the members who reside in the city where the convention is held feel called upon to offer considerable attention and entertainment to the members of the association. It entails a good deal of hard work and expense upon them, which seems unnecessary. The social entertainment features of the meetings should not be overlooked or given up entirely, as these serve to extend the acquaintance of the members with each other. I have gained quite as much information and instruction from conversations I have had with other members from different sections of the country as I have from hearing the various papers discussed in the meetings. I think that if this view of the conventions could be impressed upon those station people who are not members it would help to make them such.

"It would also be a good plan to have a Reception Committee, whose duty it would be to see that the members of the association are introduced to each other, not leaving each member to make his own acquaintances; for, although it may seem impossible, I find that there are some modest men even among the electrical fraternity who do not want to push themselves into notice, and, consequently, do not get acquainted very much, and, perhaps, do not feel that they have received any benefit from attending the conventions. The object of the association should be to bring the members together to exchange views and experiences in such a manner that it will be of practical use in the management of their business. At present the supply men of the association outnumber the station men, and as a large number of the former do not care about the papers and discussions brought before the convention, they do not attend the meetings, making it appear as if there was not much interest taken in the proceedings. I should not, however, wish to have the supply men barred out from becoming members, because a good deal can be learned from their meeting with station men, and their exhibits of the new appliances for use in the electrical business. I certainly have learned a great deal from them at our meetings.

"Still another way has occurred to me, and that is to have the National association composed of delegates which are sent from a State association similar to the one we have here in Massachusetts, which includes in its membership about seven-tenths of the electric light companies in the State, according to the amount of capital stock invested in the business. Now, if each State had a similar association which held its meetings once in three months to consider subjects of mutual interest, the State associations could then be represented by one or more delegates in the National association, which would hold its meetings once a year. I am of the opinion that more real interest would be taken and greater benefit derived than is the case in the present method, as the station men would attend their State association meetings more regularly and it would not entail so much expense as it does to attend the National association."

Mr. Chas. E. Scott, of the Bristol (Pa.) Electric Light and Power Company, whose pithy remarks at the last convention will be remembered by all who heard them, suggests the following ideas upon the same subject:

"By the rubbing together of more central station men in the convention; not such friction as would melt babbitt or destroy temper, but with the bearing of each to the other lubricated with the oil of politeness; and by a transmission of power through interchange of ideas and experience for smoothing down the financial and mechanical difficulties which have arisen or may arise in practice the association would be more beneficial to its members. Such bits of experience should occupy a portion of time when the stenographers must keep their ears closed and their pens idle, for there is much valuable information that should not be published, and the fact that it can only be gleaned by personal participation in the meetings would lead managers to consider the advisability of becoming members and participants.

"Really, however, I see no reason for suggesting anything. The association is admirably conducted. The privilege of membership is worth many times its cost to even the smallest of central stations, and your query recalls one made many years ago, to which the answer was: 'If they hear not Moses and the prophets, neither will they be persuaded though one rose from the dead.'"

These two opinions, one from Massachusetts and one from Pennsylvania, are well supplemented by the following suggestions from the pen of Mr. Geo. A. Redman, superintendent of the Brush Electric Light Company, of Rochester, N. Y. Mr. Redman says:

"I favor the holding of the conventions but once a year, and have been of that opinion since I have been connected with the association. It is impossible for many of the practical central station men to be present twice a year, and for that reason they seldom attend. I have always enjoyed not only the business part of the meetings but the social also, yet I think there should be more trading of sermons than there has been heretofore.

"The papers to be discussed should be printed and copies mailed to each member at least one week before the convention, and these should then be discussed in private sessions. The mailing of the copies to each member will make it unnecessary to read the papers during the sessions, thus giving more time for discussions.

"I am also in favor of two scientific lectures to be given during each meeting, accompanied by scientific tests, etc., to which the public should be invited. Business first and pleasure afterward is a good maxim. For the latter I would favor a banquet."

Mr. James R. Dee, of Houghton, Mich., points out a number of ways in which he thinks the association might be made more beneficial. He says: "It seems to me the best way to obtain a larger central station membership is to have the convention held in some city that can be reached from most of the country in the shortest time; and in a city that will furnish sufficient space and power for a first class exhibition of electrical apparatus, especially motors or power machines doing practical work, something on the order of the Montreal exhibition and the last one held in Chicago. Any one who was present at either of these will remember how difficult it was to obtain elbow room after 7. P. M. when everything was supposed to be in operation.

"I think when central station men (particularly we country chaps who are located so far away from factories and supply houses) find they can see and learn more by attending a convention in connection with a good exhibition than they can see and learn in going to a city factory or supply house a hundred times over and find it less expensive by a good deal, we would easily secure their attendance. Of course, we are all anxious to hear what can be said of the advantages and disadvantages of different types and makes of dynamos, engines, boilers, wires, etc., but it seems to be a hard matter to obtain this information. Still it is the information we are all after, and I hope central station men will ere long come forward and give us their experience in the business, without hesitancy and fear of injuring some manufacturer. If the latter has a defective article to sell central stations, the sooner he finds it out the better. I, for one, am in favor of supply men and manufacturers being members of the association, and I think they ought to be encouraged to become members, read papers, and take part in discussion. They are in condition to give valuable pointers, if they wish. From personal observation, they see more of central stations than central station men do. As I said before, exhibitions are more likely, in my opinion, to attract members and membership, as many think it is not necessary to go several hundred miles, and at considerable expense, to simply listen to a few papers, when they find the exact duplicate of the readings in an electrical journal. If we could hear more on the subject of economy, safety, durability, long life, etc., of a compound condensing Corliss type of engine, as compared with compound condensing high speed engines, under light and heavy loads; boilers, high and low voltage alternators and incandescent lamps, from engine, boiler and lamp manufacturers, there would be no trouble about membership in our association. We do not seem to get at the real practical points in our papers and discussions, at least not enough of them to suit central station men in general."

In considering this topic, Mr. C. A. Brown, of Chicago, refers to the often discussed question of the relations between central stations and manufacturers. He says:

"In discussing this question I can do no better than to urge the action which I repeatedly advocated in vain when I was actively connected with electric lighting interests. A committee on relations of central stations with the manufacturing companies was appointed, and, I presume, still exists. It seems to me that this committee, if given sufficient scope, could accomplish much good for the central stations. At present no manufacturing company can afford to refuse to sell apparatus, even though it knows the apparatus is to go into competition with other apparatus already in use in a place which is capable of supporting but one station. The disastrous results of such competition are well known. It reacts unfavorably upon the manufacturer in the long run, but the manufacturing companies, even if willing to prevent this competition by refusing to sell apparatus, cannot do so under the existing circumstances and conditions, because if one does not make the sale another will do so. The central station companies, through their organized representative, the National Electric Light Association, have in their own hands the remedy for an evil which affects them injuriously, in the first instance. They have the power to compel the manufacturing companies to agree not to allow its agents to work up opposition to existing companies, nor to sell to such opposition even if spontaneously organized. The manufacturing companies will not need much coercion in this matter. They recognize the evil as it at present exists, and if once assured that all would be put on the same footing, and that for one to refuse to sell no longer meant that its competitor would get the order, they would co-operate with the central station companies in this important reform. This committee or another one could also do something to extend the benefits which exist under the Massachusetts Laws of Commissioners empowered to supervise gas and electric light companies. In brief, when asked how the National Electric Light Association can be made of more value to central stations, I would say, by using its power to prevent unhealthy and unregulated competition, and it can exert this power through its influence with manufacturing companies and with State legislatures."

A Proposed Amalgamation of the National Electric Light Association and the Association of Edison Illuminating Companies.

It has more than once been suggested by members of both of these associations that there were many reasons why the two should be united into a single organization, but a union of the two has never been officially considered. Opinions, however, seem to be so strongly in favor of the proposed amalgamation that it is difficult to obtain any argument from members either of the National or the Edison associations that does not favor it. The consolidation of the Edison and Thomson-Houston companies would seem to have removed the last objection to the formation of a united association, whose membership would include every electric lighting man in the country of whatever system he happened to be the proprietor or the operator.

The following opinions by Messrs. Leonard, Francisco and Nicholls are indications of what seems to be the almost universal feeling on this very timely subject, which cannot fail to be thoroughly discussed at the Buffalo meeting of the National Association. Mr. H. Ward Leonard expresses his opinions as follows:

"My opinion is that such amalgamation would be not only mutually beneficial to the two associations, but that it would greatly stimulate the progress of electrical work in this country.

"The Edison association is primarily the continuous current low-tension side of the electrical business. The National Electric Light Association represents primarily the high-tension alternating current side of electrical matters; and I think that both associations have failed to fully recognize the valuable features of the other side of the case.

"I am a strong believer in the use of the alternating current and continuous current from the same plant. From the present outlook of the electrical business I am inclined to think that transmissions of energy—at any rate, for the immediate future—will be by the use of alternating currents; and I am equally as strongly of the belief that the utilization of the energy at the translating device, especially in the case of motors, will be by means of a continuous current.

"Having this view of the matter, I am strongly of the opinion that the amalgamation of the two associations would lead to a rapid development of combinations of existing systems which would enable us to accomplish almost any desired results by the apparatus which we have at hand to-day.

"The members of the National association have not had the opportunities that those connected with the Edison association have enjoyed relative to the distribution and application of electric energy by the continuous current. On the other hand, the members of the Edison association have had a very slight familiarity with the uses of the alternating current.

"Having been a member of both associations for a number of years, I feel confident that an interchange of views, such as would result from an amalgamation of the associations, would be of the greatest value to the electrical interests of this country."

Mr. Frederic Nicholls, manager and secretary of the Toronto Incandescent Electric Light Company, is an officer and a prominent member of the Edison association, and the next meeting of that organization will be held at Toronto. Mr. Nicholls is also well known in connection with the National association, and for this reason his opinions are worth careful consideration. On this subject he says:

"I am in favor of a consolidation of the Association of Edison Illuminating Companies and the National Electric Light Association.

"During the earlier years of electrical development it was considered 'bad form' for any one identified with any one of the parent companies to even admit a knowledge of any other 'system;' but happily this day is passed, and the membership of the National association is made up of the representatives of many rival concerns, who meet on neutral ground, and as a result gain experience, form friendships, and learn to respect their competitors even though they cannot agree with them. Any association organized for the purpose of conserving mutual interests must be established on a higher and broader plane than that of narrow individualism. It must be sustained by the energy and activity of those whose interests are directly involved must be numerically strong enough to command respect and sufficiently representative of the various branches of the electrical industry to be considered authoritative.

"I have taken an active interest in each association and cannot see that the interests of either would suffer from consolidation, but rather that influence and prestige would accrue to both. At present, those who represent capital invested in electrical enterprises 'must take the current when it serves or lose our ventures.' We must of necessity keep posted on every advance and improvement, and when we find improvements of merit take advantage of them, irrespective of any name or any system. We must adopt the most suitable machines and apparatus for the particular duties expected of them, and in no more satisfactory way can one form an intelligent opinion of their merits than by independent discussion with practical men.

"I hold the view that not only amalgamation of the two associations referred to should be aimed at but that other

kindred organizations could coalesce with advantage and profit. In such event, special sections devoted to special interests could be formed, which could meet privately during the term of the convention in the same way as committees of the association.

"The manifest advantage of attendance at a great representative gathering would bring together a large number who would neither devote the time nor money necessary to attendance at meetings of an association of narrower scope.

"Lord Bacon, in one of his essays, writes, 'There is surely no greater wisdom than well to time the beginnings and onsets of things,' and I trust that with your usual foresight you have directed attention to this matter at the proper moment."

The views of Mr. M. J. Francisco, of the National association, probably are typical of those of nearly all who have carefully considered the subject. He says:

"I see no objection or reason why these two associations, which represent the electric lighting interests of the United States, should not be amalgamated, while there are many arguments in favor of their joining hands.

"The object of the Edison and National associations is to aid and benefit central station men, and if I, as an active member, can secure the knowledge obtained by the actual experience of all the men in the National and Edison associations, its value to me, as a central station manager, cannot be over-estimated.

"The combination would become one of the strongest, if not *the* strongest and most important electrical association in the world. There are many members of the National association who are also members of the Edison, and also many who use the Edison system. It entails a heavy expense to hold a membership in both associations and attend their conventions. By this union the members of each association would save one membership fee and the expense of two conventions, and, at the same time, would secure the combined experience of both.

"Again, the members of both associations working together, the feeling of jealousy which has existed would be destroyed, and the union, including among its members all the acknowledged electrical inventors and scientists, would become such a power as to mold and guide public sentiment upon electrical questions and industries of the country. I trust and hope that such a union may be speedily effected."

Mr. John I. Beggs, the president of the Association of Edison Illuminating Companies, touches the keynote of the question, when he says:

"If the general business of electric lighting were to be continued in the same channels in which it has been run for some years past, I would not favor such consolidation; but if the consolidation of the Edison General Electric and the Thomson-Houston companies is consummated the changed conditions necessarily brought about thereby might change my opinion. Of this I could not judge until I knew in just what form the consolidation of the larger interests was finally perfected."

Mr. F. S. Terry has been a very energetic worker in the National association, and his ideas upon the advisability of the amalgamation of the two organizations will be read with interest. He looks at the question from the standpoint of the Edison man. He says:

"The National association is intended to include all lighting companies of whatever kind and using whatever system. If any lighting company using either the Edison or another system does not consider that a membership in the National association will prove beneficial, it naturally will not join; and there is no reason why the Edison companies should not belong to the National association, even if they do also belong to the Edison association. Some of the benefits that the Edison companies derive from having an association of their own are as follows:

"1st. As the interests of all are identical, every subject considered will be of interest to each member.

"2d. As all of the companies in the association have identically the same system, any information given by each and the comparison of costs, expenses, etc., can be made by each company with others where most of the conditions are identical. This is not the case where a direct current is compared with an alternating current.

"3d. It being an Edison association, the Edison parent company takes more interest in it than it would in the National association, and gives valuable information which would not otherwise be obtained.

"4th. Companies using the Edison system are more likely to attend the Edison than the National conventions.

"5th. The number of companies operating the Edison system is sufficiently large to form an association which is complete in every particular, and will give every advantage that could be obtained from the National association.

"6th. Being a smaller association, the members will become better acquainted and get more information of practical benefit to them than they could obtain from being members of the larger association.

"7th. As the conditions of all of the companies are practically the same, they are able to adopt general plans for operating their stations, keeping their accounts, etc., that will serve all equally well.

"8th. As the members of the Edison association can obtain every possible benefit from the Edison association, and as some of the benefits they are now obtaining could not be obtained to the same extent from the National association, I see some reasons why they should continue to have an association of their own and none why they should consolidate with the National association, if consolidation would mean the giving up of their own.

"It seems to me that the Edison association is a sort of a family, while the National association is the general class, and I think probably every Edison lighting company would find it beneficial to belong to the National association for the general information it might obtain beyond what it could obtain from the Edison association."

The Organization and Proposed Work of the Canadian Electrical Association.

BY J. J. WRIGHT.

The impression that the formation of a Canadian Electrical Association was the outgrowth of the interest created by the meeting of the American Association in Montreal last September, though general, is scarcely correct. It is now nearly two years since the formation of a distinctly Canadian association was discussed. To refer back to the time of its inception, as recorded in the Canadian electrical press, we find that the original proposition was made by a gentleman well known in Ontario, Mr. S. J. Parker, Treasurer of County Grey and president of the Owen Sound Electric Light and Manufacturing Company. He sought expressions of opinion from other electric light men on the subject, and has been ever since one of its most enthusiastic advocates.

J. J. WRIGHT,
President.

K. J. DUNSTAN,
First Vice-President.

JOHN CARROLL,
Second Vice-President.

C. H. MORTIMER,
Secretary Treasurer.

The idea was taken up by Mr. C. H. Mortimer, the editor of the *Mechanical and Milling News*, an industrial paper, then devoting much space to electrical matters, and since having been converted entirely to electrical and engineering interests. The issue of February, 1891, speaks of the increasing interest being taken among electric light men in the proposition to form an electric light association in Canada. It speaks of the successful electrical organization of the United States, and while awarding a due meed of praise to that enterprising body, feels that what is required is something distinctively Canadian. Electric light men, as a rule, are busy men, with scarcely leisure enough to keep track of the many improvements and developments being constantly made in their art. The meetings of the American association being held anywhere, from Maine to New Orleans or San Francisco, are altogether too inaccessible to the modest and busy Canadian, so it was suggested that the forthcoming industrial exhibition, to be held in the following September, would be a good time for a gathering of representative men, Toronto being a central location and the Industrial a suitable place, as being the objective point of visitors from all parts of the country.

It was somewhat unfortunate that about this time it was decided to postpone the date of the National Association meeting in Montreal to the identical week in September allotted to the Toronto Industrial Exhibition, a change of date that no doubt prevented a number of electrical men whose engagements held them there from being present at the convention in Montreal. However, in response to cards of invitation, or rather of intimation that a meeting of those interested in electrical matters would be held, a large gathering took place in the board room of the exhibition offices, kindly placed at their disposal by the officials, of representatives, not only of electric lighting companies, but also from the leading telegraphic and telephone interests of the Dominion. It was from this nucleus that the Canadian Electrical Association has developed.

A meeting for organization was held in Toronto in November last at which provisional officers were appointed and a constitution and by-laws drafted. The following are the names of the officers appointed to act until the first annual meeting to be held in June next in the city of Hamilton: President, J. J. Wright, manager Toronto Electric Light Company; first vice-president, K. J. Dunstan, local manager Bell Telephone Company; second vice-president, John Carroll, Eugene Philips Electrical Works, Montreal; secretary-treasurer, C. H. Mortimer, editor *Electrical News*. Executive committee, E. S. Edmonson, Electric Light Company, Oshawa; H. O. Fisk, electrician Electric Light Company, Peterboro; W. A. Johnson, manager Ball Electric Light Company, Toronto; S. J. Parker, managing director Owen Sound Electric Light Company; A. B. Smith, inspector Canadian Board Fire Underwriters, Toronto; D. Thomson, general manager Hamilton Electric Light Company; Thos. H. Wadland, superintendent construction Bell Telephone Company; A. A. Wright, Electric Light Company, Renfrew; John Yule, managing director Guelph Gas and Electric Light Company.

That there is abundance of material among electrical workers in the Dominion to draw upon in forming an association distinctively Canadian will be at once conceded when it is understood that there are in the country, holding positions of trust, and in charge of its most important electrical enterprises, some of the earliest pioneers in the field of electrical development—men whose experience is contemporaneous with the introduction of the first electric light as an article of commerce on the North American continent and who have kept in step and in touch with all the developments of electricity as an industrial and commercial factor up to the present time. Not only are men of experience available, but the commercial and manufacturing interests of the Dominion are sufficiently extensive to warrant their welfare being considered from a distinctively Canadian standpoint.

There might and indeed would be certain advantages to Canadian electrical men in casting in their lot with the National Association of the United States, which is a growing and powerful organization, but as that nation is striving to accentuate the line of demarcation between the two countries in a commercial point of view, the time appears to be opportune for Canadians to form an alliance of electrical interests that would make a further strengthening of that barrier a matter of less moment than might otherwise be the case. In the protection of these various interests, the maintenance of a profitable method of business and the elimination of undesirable and unfair competitive depreciation of values, there is a wide field of usefulness for an association comprising the business element and backbone of the industry in Canada.

One of the most fruitful sources of unfair competition spoken of has been the entire lack of a recognized standard of current to be used in the production of arc lights of certain specified nominal candle power. It will be the province of the association to introduce and have recognized a specific standard that shall be used by companies and municipalities in their dealings with each other. This is but one of the many questions of importance to the industry that will call for intelligent discussion and settlement at the forthcoming annual meeting at Hamilton. Questions of legislation, both provincial and municipal, will also receive their share of attention. The presence in the association of members of the telegraphic and telephonic fraternities will also serve to add to the interest of the gathering, and it is expected that electric railroad men will also make their presence felt. The citizens of Hamilton are noted for their hospitable characteristics, and, having among them two resident members of the Executive Committee, may be depended upon to do their share toward making the gathering a complete success.

A meeting of the Executive Committee was held in Toronto on the 10th inst., at which a number of applications for membership were passed upon and sub-committees appointed to provide accommodation for exhibits and formulate a programme of proceedings for the convention. Among the papers expected to be read and brought forward for discussion will be one on electrical standards for arc lighting, on the economical production and distribution of electricity for power, on overhead line construction, on the

comparative value of arc light carbons of various sizes, results of municipal operation of electric light plants as developed in Canada, and others of practical interest to the fraternity. There is also a paper in preparation of especial interest to telephonists. Power for the use of exhibitors will be provided from the new central station of the Hamilton Electric Light Company.* Among the features of interest will be the new central exchange of the Bell Telephone Company,† one of the handsomest and best equipped on the continent. The committee will spare no effort to make this a thoroughly representative exposition of Canadian electrical progress.

A Proposed System of Alternating-Direct Current Transformation.‡

BY LIEUT. F. JARVIS PATTEN.

Recent German practice has given unforeseen importance to all devices for transforming and rectifying alternating currents. The year just passed has been fruitful in the development of multiphase systems, and the new departures are marked by novelty and ingenuity. I have followed these steps with close attention, for they open to the electrical engineer a comparatively new and very interesting field.

The system of transformation which it is the purpose of this paper to lay before you has arisen mainly from my study of multiphase current developments, and I style it a proposed system, because I have not yet had an opportunity to test it in the completed form, and can, therefore, give no data as to efficiency.

Quoting an author who has written interesting descriptions of multiphased apparatus for the *Electrical Review*, of London, after describing the Shuckert motor transformer, which, you will remember, was brought to your notice by Mr. Carl Hering in his interesting reminiscences of the Frankfort Exhibition, the author, in closing, sums up as follows:

"The present importance of these currents (multiphased) may be greatly diminished by the discovery of an apparatus capable of transforming a single alternating current economically into a continuous current. It is also possible, and even probable, that multiphased currents will constitute merely a transitory system, as the Jablochkoff candle constituted a transitory system between the arc and incandescent lamp."

While it is not my desire to detract in any way from the known merits and beauties of multiphase systems, I have always maintained that two wires ought to be sufficient for all purposes, and the system here presented is simply offered as a solution of the problem of obtaining electrical energy in any desired form from a single high tension alternating current.

To merely reverse all the positive or negative impulses of a single alternating current would evidently not be a solution of this problem. The resulting current and the magnetism it produces are pulsating in character, having zero periods at each reversal of current. A useful direct current must be obtained, or one having a practically uniform electromotive force.

To explain the methods used, I must direct your attention briefly to a former paper, read about two years ago, describing an alternating motor which was new at that time, as well as to the Shuckert machine before referred to.

A combination of the functions of these two machines renders possible a number of singular and interesting transformations, which, if they are not entirely novel, any description they may have received has escaped my notice.

The essential features of what for convenience I will style the "Patten motor" are shown in Figs. 1 to 3 of the drawings, and the Shuckert machine is shown by diagram in Fig. 6.

To explain the former, Fig. 1 is an ordinary Gramme winding and collector, in which a direct current applied to the brushes would make, say, the poles indicated *n* and *s*. A source of alternating current connected to the brushes, however, would reverse the polarities of the ring at each reversal of current, and the tendency to motion would of course be reversed if the fields remained the same, but would continue in the same direction if the fields were also reversed by the same alternations of current. If, however, the fields *N* and *S* were maintained constant, and by some device the brushes b_1 and b_2, Fig. 1, could be made to change places at each reversal of current, then with an alternating current the polarities *n* and *s* of the ring would remain unchanged, and in a constant field the tendency to motion would still be continuously in the same direction.

It is not practicable to move the brushes mechanically, but the same effect is obtained by the system of armature connections shown in Fig. 2, where the odd numbered bars of the collector are connected to the winding in the usual way, but the intermediate even numbered segments are connected to points of the winding diametrically opposite to them.

Such an armature, supplied with an alternating current and placed in a two-pole field, will turn through the arc covered by one collector bar at each reversal of current, the polarity of the ring remaining unchanged, as will be seen by tracing two successive impulses, shown respectively by the single and double arrows.

If, besides, the collector just described, another be connected to the winding in the ordinary way, like the outer one in Fig. 3, where, to avoid confusing the drawing, the source of alternating current is shown inside the collector, then evidently brushes bearing on the outer collector will give, as indicated, a current of one direction to any circuit connected to them, as that used for exciting the fields, *N*, *S*, Fig. 3. Thus connected, the machine starts itself as

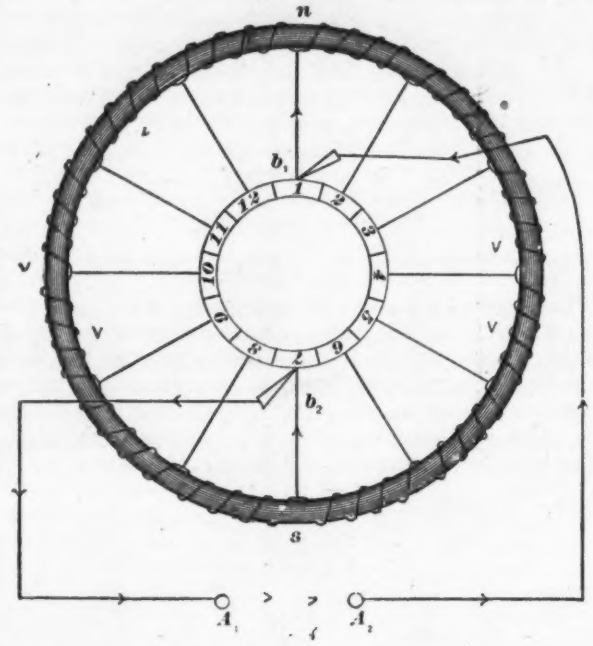


FIG. 1.—PATTEN'S ALTERNATE CURRENT TRANSFORMATION.

would a direct current motor, both fields and armature reversing, but it will continue gaining in speed until one segment of the collectors passes the brushes at each reversal of current, when it becomes a synchronous alternating motor, having a fixed and uniform speed—that of commutation. And it may be given almost any speed as compared to that of the generator and yet be in synchronism, by suitably altering the winding and giving the motor commutator a greater or less number of segments. Reference will now be made to what will be styled the "Shuckert" machine, a diagram of which is given, and which will be found extensively described in the London *Electrical Review* of Nov. 20 and Dec. 25, 1891. It consists of an ordinary Gramme winding and collector, the latter shown for convenience outside the ring. There are also three separate ring contacts, r_1, r_2, r_3, provided with brushes, *a*, *b*, *c*, and the rings are connected each to one of three equidistant points of the armature winding, *x*, *v*, *y*.

Such a system admits of two important transformations, namely:

A direct current applied at the brushes b_1, b_2, bearing on the collector, causes the armature to turn, and triphased

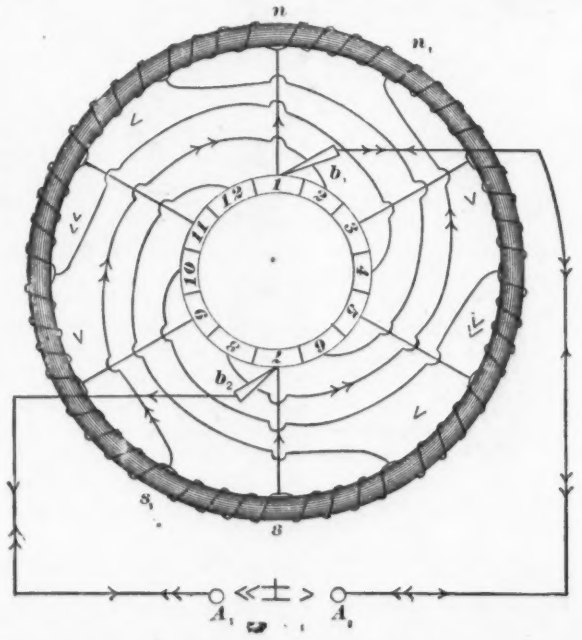


FIG. 2.—PATTEN'S ALTERNATE CURRENT TRANSFORMATION.

alternating currents can be collected in circuits connected to the brushes *a*, *b*, *c*. It may be noted here, in passing, that these latter will reverse at each half revolution.

*Or conversely triphased alternating currents supplied at the rings through the circuits connected to the brushes *a*, *b*, *c*, will cause the armature to turn and (when in synchronism) a uniform direct current will flow in any circuit connected to the brushes b_1 and b_2, bearing on the collector. The machine thus transforms triphased alternating currents into a uniform direct current or the reverse. If the functions of this machine and that previously described be combined, other novel transformations will result, as it is evidently only necessary to supply a current of approximately uniform E. M. E. to the collector brushes to obtain triphased alternating currents in circuits connected to the brushes *a*, *b*, *c*, or the rings.

* For a description of this plant see THE ELECTRICAL WORLD, Sept. 12, 1891.
† For illustrated description of this exchange see THE ELECTRICAL WORLD, Nov. 15, 1890.
‡ A paper read before the American Institute of Electrical Engineers.

Annual Versus Semi-Annual Meetings of the Association.

During the past year a question often discussed in connection with the meetings of the National Electric Light Association has been that of the advisability of dispensing with one of the yearly meetings. What a number of the prominent members think upon this timely subject will be evident by a perusal of the opinions given on this page. Judge Armstrong, whose arguments upon important topics have so often been heard at the convention meetings, says upon this subject:

"I recognize the fact that there are two sides of the question as to semi-annual meetings of the National Electric Light Convention and the only objection to semi-annual conventions, it seems to me, is the length of time all men interested in electric lighting and power have at their disposal. The advantages of frequent meetings and the discussions of live and important topics and exchange and interchange of business ideas and notions, as well as of the scientific fancies concerning the business, are of inestimable benefit to the stockholders of companies represented in the membership of the convention. While a week taken out of the busy part of the year is a heavy tax on a man whose time is fully employed, yet I am inclined to believe that the two weeks devoted to our attendance at the conventions is time well expended. While I am perfectly willing that the summer meeting of the convention should be dispensed with, if the majority think wise, personally I should be pleased to see, for some time yet, the semi-annual conventions. Let the topics be live and active ones and the papers be upon practical and practicable subjects by men acquainted with them, and we will never have occasion, I imagine, to lament a slim attendance."

Mr. A. J. DeCamp, another member who has always had the best interests of the association at heart, says:

"I am and have been for some time of the opinion that the interest of the association would be best served by dispensing with the summer meeting, and if the matter comes up at the Buffalo convention, I shall do what I can to that end. While you do not express your own views on the subject, I trust you will use your influence in that direction."

Mr. E. R. Weeks, ex-president of the association, puts his opinion briefly in these words: "For several years I have advocated but one convention a year, and I see no reason to change my opinion."

Mr. E. W. Rollins, of Denver, although he has been compelled to travel more than 2,000 miles to attend any of the former conventions, with the single exception of that of Kansas City, is still in favor of two meetings a year. He says:

"I believe that the meetings of the association are productive of very good results, and I feel that the more frequently the men interested in operating light plants can meet together within reasonable limits the better; and my preference, therefore, would be for semi-annual meetings. These are, perhaps, advantageous to men living long distances from Eastern points, for while the more far-away members cannot attend a meeting in the winter they may be able to do so in the summer, or vice versa."

Mr. C. O. Baker, Jr., has been such an energetic worker at all of the recent conventions that he is competent to testify as to the great amount of labor that must be expended in the preparation of two meetings each year. On this subject Mr. Baker says:

"I can testify that the amount of labor in preparing for a meeting of the association is very great, and, unless our active members derive considerable benefit from the convention, I would personally be very glad to see the summer meeting discontinued."

Mr. C. Lee Abell gives some very emphatic reasons for the discontinuance of the semi-annual meeting. Here are his opinions:

"I am heartily of opinion that one convention a year is sufficient, and in the end will be for the benefit of the association. With two meetings a year it takes so much time, not alone at the convention itself, but in the preparation for it and in going and coming, that to find this time is a severe tax upon the central station men, and particularly on those who are handling the smaller or intermediate stations, and it seems to me that those are the men that we need at our conventions and who can get a large amount of good from them. I am of the opinion that if once we can get the men representing the smaller stations actively interested in the association, so that they can realize its benefits, they will always be with us. With one convention a year I do not hesitate to say that there is not a central station man but what can and will join the association for the benefit that he can derive from it."

Mr. Allan R. Foote, ex-secretary of the association, points out the fact that a change in the policy of the association is compulsory if the present high position of that organization is to be maintained. He says:

"This is a question of policy, not of principle. The association exists for the benefit of its members. If it is to prosper and extend its sphere of usefulness, it must do those things that will most benefit the interests it represents, and will give them help when they most need it.

"I have often remarked upon the lack of growth in the membership of the association. It bears no relation whatever to the interest manifested in its conventions by all

classes of interests in touch with the electrical industries, and by the general public. It has seemed to me that the reason for this is to be found in too frequent conventions. Those who have been responsible for the success of a convention know how keenly they feel the lash of necessity to make the coming convention a greater success than the last one.

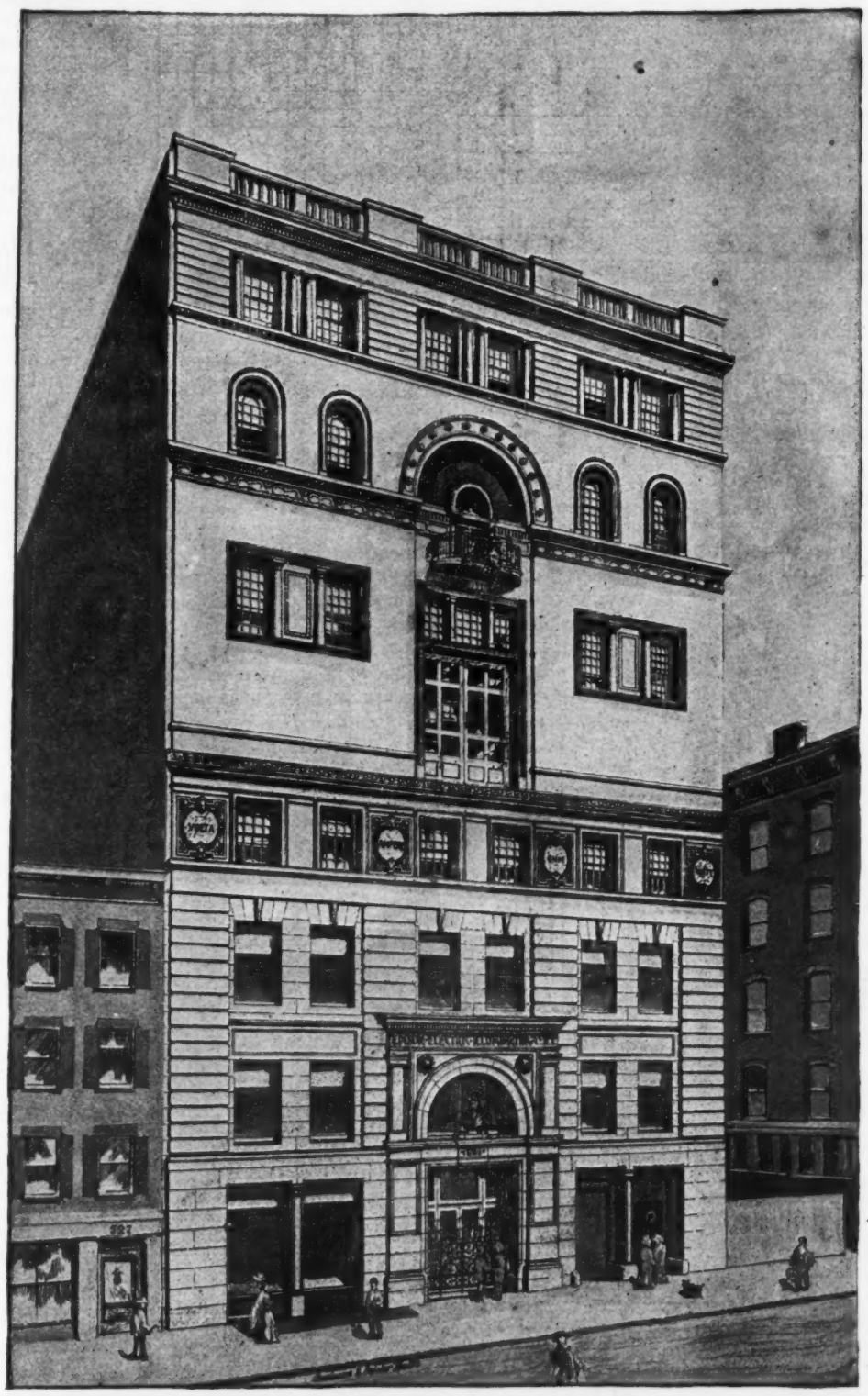
"My voice is for an annual convention only. This policy agreed upon, the administration of the association can then give its attention to the development of those features of usefulness which must benefit the interests it represents through other circuits than contacts formed at conventions. When it commences to work on these lines it will have benefits to offer that do not depend upon attendance at a convention; benefits that will be valuable to those who, by reason of distance or other cause, cannot attend a given convention; benefits that will be valued above the cost of membership by all whose names once have a place on the rolls. Under such conditions there will be no hiatus in the membership of any company, and the large number of companies whose names have never yet been upon the association's roster will have a good business reason for being there. Give them such a reason and there they will be.

"The first and most essential step now to be taken by which to reach this consummation is to change the policy of the association in respect to its conventions, to hold annual conventions only, and then to devote the energy thus released to the doing of those things which will most surely benefit the interests involved, even though their representatives never meet in convention. This done, membership will come to it by the resistless force of the law of controlling attraction."

The New Station of the Edison Illuminating Company in New York City.

Owing to the rapid growth of the electric lighting business in this country there are perhaps not more than a dozen central stations whose design and construction have been carried out in accordance with the latest and best engineering practice. Central stations, as a rule, have been hurriedly constructed with any sort of material that happened to be near at hand and equipped with that apparatus which was offered at the lowest rates. The station which is illustrated on this page is therefore of more than usual interest, since in its construction every possible improvement has been introduced which in any way promised to increase the efficiency of the plant and to reduce the cost of operation.

This station is the new one of the Edison Electric Illuminating Company of New York City, to which reference has already been made in the columns of THE ELECTRICAL WORLD. It is located on Pearl and Elm streets, having a frontage on Pearl street of 75 feet and extending back 200 feet. Its total height, one of its most striking features, is 170 feet. The engine room is situated on the first floor, which alone is 40 feet high. Immediately above the engine room are storerooms, offices and hot air tanks. Next above these is a mezzanine floor, on which are the pumps, ash conveyers, etc. On the next floor above is the boiler room, which is 25 feet high, and is designed for a capacity of 30,000 to 40,000 h. p. The boilers are not far from 60 feet above the engine room.



NEW EDISON CENTRAL STATION IN NEW YORK CITY.

The first installation of engines and dynamos will consist of either four or six engines of 1,500 h. p. each, of the same type as that recently built for the Twenty-sixth street station of the Edison company, and which was illustrated in THE ELECTRICAL WORLD of Jan. 23, 1892. It is contemplated that additions will be made of units of 4,000 or 5,000 h. p. each; six of these have been planned for.

The piping is done in parallel, the pipes consisting in most cases of 8-inch copper wrapped with steel wire. The flanges are 4 inches thick, fastened with bolts 2¼ inches in diameter. The boiler pressure contemplated is from 200 pounds up, as the conditions may require.

Above the boilers are placed the coal bunkers, which have a total capacity of 3,000 tons. On this floor next to the bunkers are also additional hot air tanks. These hot air tanks are a special feature of the station, and by their use it is expected to secure a considerable increase in station efficiency. It is expected to work with closed fire and engine rooms and to utilize the hot air radiated in these rooms. This is done by forcing cold air under the floor by means of which the hot air will be driven upward to the hot air tanks. From these it is passed through the flues and there heated to approximately 350 degrees.

From these the hot air passes to the ash pits, thence upward through the furnaces. This system is to be operated under the Man patents.

The design and construction of the entire station has been done by Mr. J. Van Vleck and Mr. R. R. Bowker, both of the Edison Electric Illuminating Company, and by the means adopted they hope to gain an efficiency of operation approximating that of marine engines.

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Chronological History of Electricity, Galvanism, Magnetism and the Telegraph, from B. C. 2637 to A. D. 1888.—Part I.

BY P. F. MOTTELAY.

A. D. 1798.——Monge (Gaspar), Comte de Peluse, a very able French scientist, called "the inventor of descriptive geometry," and from whom that science received greater accessions than had before been given it since the days of Euclid and Archimedes, constructs a telegraph which is erected upon the "Palais des Tuileries" in Paris, but of which no reliable details appear on record.

He also makes many experiments on the effects of optics and electricity, and, likewise, many useful observations on the production of water by inflammable air, independently of those carried on by Lord Cavendish.

See his biography in Charles Dupin's "Essai Historique, etc.," and in "English Cycl.," vol. IV., pp. 296, 297; G. Monge, "Sur l'effet des étincelles . . .," Paris, 1786, and "Précis de leçons," Paris, 1805; *Sci. Am. Supp.*, No. 621, p. 9,916, and the note at foot of page 701 of Fifth Dissert., 8th Brit., vol. I., as well as "Mém. de l'Acad. des Sciences," 1786.

A. D. 1798.——Berton (Henri Montan), a prominent French composer and professor of harmony at the Paris "Conservatoire de Musique" and member of the "Académie des Beaux-Arts," devises a novel electric telegraph which is merely alluded to, under the heading of "Note historique sur le télégraphe électrique," at page 80 of the 7th volume of the *Comptes Rendus* for July, 1838, as well as in Julia Fontenelle's "Manuel de l'électricité."

A. D. 1799.——Fabbroni—Fabroni (Giovanni Valentino M.), professor of chemistry at Florence, communicates to the *Journal de Physique* (9th series, tome VI., Cahier de Brumaire, an. VIII.), an amplification of his able memoir, "Sur l'action chimique, etc." ("Dell' azione chimica . . . "), which was first presented by him during 1792 to the Florentine Academy and duly analyzed by Brugnatelli in his "Giornale physico-medico," and wherein is made the first known suggestion as to the chemical origin of Voltaic electricity. He inquiries whether the phenomenon of galvanism is not solely due to chemical affinities of which electricity may be one of the concomitant effects. He ascribes the violent convulsions in a frog to a chemical change produced by the contact of one of the metals with some liquid matter on the animal's body, which latter decomposes and allows its oxygen to combine with the metal.

See "Elogio . . . A. Lombardi" ("Mem. Soc. Ital.," vol. XX.); *Cornhill Magazine*, vol. II., for 1860, p. 68; "Biog. Univ.," vol. XIII., p. 311; "Encyl. Met.," "Galvanism," vol. IV., p. 215; *Journal de Physique*, vol. XXLI., p. 348; "Chambers' Ency.," 1868, vol. IV., p. 593; "Mem. Soc. Ital.," vol. XX., pp. 1 and 26; *Nicholson's Journal*, quarto, vol. IV., p. 120; Sir Humphry Davy, "Bakerian Lectures," London, 1840, p. 49; Young's Lectures, vol. I., p. 752; W. Sturgeon, "Scientific Researches," Bury, 1850, p. 156, "Giornale di fisica" for 1810; "Giornale dell' Ital. Lettera . . . ," IX., p. 97; "Atti della Reg. Soc. Economica di Firenze," XX., p. 26; Brugnatelli, *Annali di chimica*, II., p. 316 and XXI., p. 277; C. Henri Boissier, "Mémoire sur la décomp. de l'eau, etc.," Paris, 1801, *Journal de Physique*, Prairial, an. IX.

A. D. 1799.——Hemmer (J. J.), celebrated physician and secretary of the Meteor. Society of Mannheim, gives, in the "Transactions of the Electoral Society," an account of the most complete series of experiments ever made upon the electricity of the human body. They show conclusively that the human subject possesses no species of electrical organs which are at all under the regulations of the will. Of his many observations, the following are worth recording: He found that the electricity of the body is common to all ages and sexes; that its intensity and character often vary in the same body (in 2,422 experiments, it was 1,252 times positive, 771 times negative and 399 times imperceptible); that the electricity of the body is naturally positive, it being so when subject to no violent exertion, and that when the body is subjected to sudden or violent motion the electricity becomes negative, which is also its character when the body experiences cold or extreme lassitude.

See "Encyclopædia Britannica," vol. VIII., 1855, p. 571; "Rheinische Beiträgen zur Gelehrsamkeit," for 1781, Fifth Book, pp. 428–466; Von Swinden, "Recueil, etc.," La Haye, 1784, vols. I. and II., *passim*; "Observ. sur la Phys.," July, 1780; "Comment. Acad. Theod.-Palat., vols. IV., V. and VI. of Phys.; "Mém. de l'Acad. de Mannheim," vol. IV.; "Pfalzbayr. Beiträge," for 1782; "Rheinische Beiträg zu Gelehr.," for 1781.

A. D. 1799.——Jadelot (J. F. N.), French physician, translates Humboldt's work on Galvanism, under the title of "Expériences, etc.," wherein he reviews the investigations of the great German scientist and treats largely of the application of the Galvanic fluid in medical practice. The observations of a friend of Humboldt, Dr. C. J. C. Grapengiesser, are especially detailed and a complete review is made of all the noted physicians who have recorded experiments in the same line.

For the medical applications of Galvanism, consult *Journal de Physique*, vol. LII., pages 391, 467; Gilbert's "Annalen," XI., 351, 488 and XII., 230, 450; "An. of Sc. Disc." for 1865, page 123; Larrey, 1793, 1840; L. Desmortiers, 1801; Legrave, 1803; F. J. Double, 1803; J. Nauche, 1803; "Galv. Soc." (*Phil. Mag.*, vol. XV., page 281); Laverine, 1803; Mongiardini and Lando, 1803; F. Rossi, 1803–1827; J. Schaub, 1802–1805; B. Burkhardt, 1802; Mr. Butet, 1801; J. Le Roy d'Etiolle, "Sur l'emploi du Galv . . ."; P. L. Geiger, 1802–1803; J. D. Reuss in "De Re Electrica"; M. Buccio, 1812; La Beaume, 1820–1848; P. A. Castberg (Sue, "Hist. du Galv.," IV., 264; Fabré-Palaprat and Le Beaume, 1828; Rafn's "Nyt. Bibl.," IV.); C. C. Person, 1830–1853; S. G. Marianini, 1841; C. Usiglio, 1844; F. Hollick, 1847; G.

Stambio, 1847; Du Fresnel, 1847; H. de Lacy, 1849; Mr. Récamier, J. Massé, 1851; R. M. Lawrence, Robt. Barnes, Crimotel de Tolloy, 1853; Mr. Middeldorpf, 1854; R. Remak, 1856, 1860, 1865; J. Seiler, 1860; V. Von Bruns, 1870.

A. D, 1799.——Humboldt (Friedrich Heinrich Alexander, Baron Von), (1769–1859), native of Berlin. is the author of "Cosmos" so frequently alluded to in these pages, and, in the words of one of his biographers, "will be remembered in future times as perhaps, all in all, the greatest descriptive naturalist of his age, the man whose observations have been most numerous and of the widest range, and the creator of several new branches of natural sciences."

The French translation of his work on Galvanism ("Expériences sur le Galvanisme . . . traduit de l'allemand par J. F. N. Jadelot") appeared in Paris during the year 1799, before which date, Noad remarks, no one had applied the galvanic arc, as he did, to so many animals in various parts of their bodies. Among other results, he discovered the action of the electric current upon the pulsation of the heart, the secretions from wounds, etc., and he proved upon himself that its action was not limited to the sole instants of the commencement and end of its passage.

In the first volume of his very interesting work on "Galvanism" (pp. 166–174, 261–310, 407–434) Wilkinson reviews the above-named publication which Mr. Vassalli-Eandi, in 1799, pronounced "the most complete that has hitherto appeared." The following extracts are mainly taken from Mr. Wilkinson's book, part II., chapter IX. Humboldt's first experiments were made in the presence of M. Venturi, Professor of Natural Philosophy at Modena, and they were followed quite assiduously for a while, but it was not until he learned of the important observations made by Fowler, Hunter and Pfaff on animal electricity and irritability, that he was spurred on to further extended investigations, which were witnessed more particularly by Jurine, Pictet, Scarpa, Tralles and Volta. Humboldt's work is divided into ten sections, as follows:

Sec. I. treats of the relation between galvanic irritation and incitability.

Sec. II. deals with the galvanic irritation produced without a coating, or metallic or charcoal substances (repeating the experiment of Mr. Cotugno, which led to the experiments of Vassalli during 1789).

Sec. III. treats of the excitement produced by a simple me allic substance, or by homogeneous metallic parts (detailing the experiments of Aldini, Galvani, Berlinghieri, Lind, Pfaff and Volta).

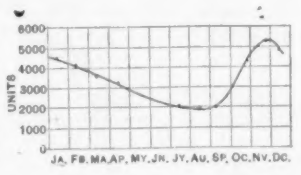
Sec. IV. discourses on heterogeneous metals. During his experiments in this line, which were aided by his elder brother, chance led him to a very interesting discovery. He found that the coatings of the nerve and muscle being homogeneous, the contractions may be produced when the degree of excitability is extremely feeble, provided the coatings of this nature are united by exciting substances, among which there is a heterogeneous one, having one of its surfaces covered by a fluid in a state of vapor. This observation, which was originally made at the commencement of 1796, surprised Humbold, so much that he instantly communicated it to Soemmering, Blumenbach, Herz and Goethe. He had not as yet found recorded in the published works on galvanism any experiment the result of which had the smallest analogy with his discovery; and it was not until after the publication of the works of Pfaff on animal electricity that he became acquainted with any one similar to his own. There were, however, some differences, as he proves by several passages cited from the above author.

Sec. V. relates the classification of active substances into *exciters* and *conductors* of the galvanic fluid.

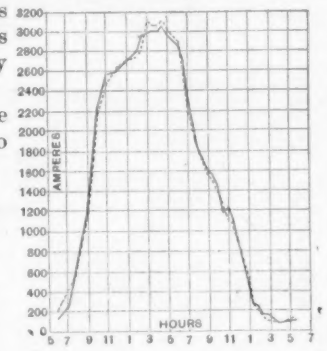
Sec. VI. treats of experiments on the comparative effects of animal and vegetable substances employed in the galvanic chain.

Sec. VII. describes, in a tabular form, the conducting substances, and those by which the galvanic fluid is insulated. In the employment of very long conductors, it was not possible for Humboldt to remark any interval between the instant when the muscle contracts and the moment the contact of the conductor takes place, the muscle and nerve being from two hundred to three hundred feet distant from each other. This announces a celerity of twelve hundred feet per second. The effect would be the same, should the conductors even be from ten thousand to twenty thousand feet in length. Thus Haller, in his physiology, ascribes to the nervous fluid a swiftness sufficient to enable it to run over a space of nine thousand feet a second. The calculation of Sauvages is carried to thirty-two thousand four hundred feet in the same space of time; and what is still infinitely more surprising, its celerity is estimated by the author of the essays on the mechanism of the muscles at five hundred and seventy-six millions of feet (upward of one hundred thousand miles) in the above space of a second of time. It ought here to be noticed that the great differences in these calculations arise from the different kinds of experiments on which they are founded.

Sec. VIII. proves that the nerve which is intended to excite contractions in a muscle, should be organically united with it, and it deals with the effects of galvanism upon vegetables, aquatic worms, insects and fishes.



1891.—Curve Typical of the Monthly Variations in Demand.



Dec. 22, Total Units, 7,942. Deep Fog.

Section IX. describes the effects of galvanism upon amphibious animals, referring to the observations of Nollet, Rosel, Haller, Spallanzani, P. Michaelis and Herembstads.

Sec. X. treats of the all important effects of galvanism upon man, and makes allusion to the experiments of Hunter, Pfaff, Fowler, Munro, Robinson, Hecker, Corradoni, Achard, Grapengiesser, Schmuck, Ludwig, Creve, Webster and Volta. In speaking of the observations made by the last named upon the tongue, he observes that some idea of them had been given thirty years before, in Sultzer's work entitled "The new theory of Pleasures," published in 1767; and that if, at the above time, the consideration of the superficial situation of the nerves of the tongue, had led to the artificial discovery of a nerve, the great discovery of metallic irritation would have been made in the time of Haller, Franklin, Trembley, Camper, and Buffon. How great a progress would not this discovery have made if the above philosophers had transmitted to us, thirty years ago, the theory and experiments which we leave to our successors?

physiologists as Coulomb, Fourcroy, Vauquelin, Charles Sabathier, Halle, Pelletan and Guyton de Morecau, who were afterward joined by both Humboldt and the celebrated Venturi, of Modena.

Humboldt's observations respecting the application of galvanism to medicine are embodied in his well known letter to Mr. Loder, inserted in "La Bibliothèque Germanique," vol. IV., Messidor, an. VIII., page 301, and are likewise detailed by Wilkinson (chap. XIII.) where references are made, more particularly, to the experiments of Hufeland, Behrends, Creve, Hymly, Pfaff and Anschell.

Between the years 1799 and 1804 Von Humboldt made observations upon the magnetic intensity of the earth, of which an account will be found in vol. XV. of the *Annalen der Physik*. These were made upon the American Continent during the course of his well known journey, the equal of which latter, says Petersen, has not been seen since the days when Alexander the Great fitted out an extensive scientific expedition for Aristotle.

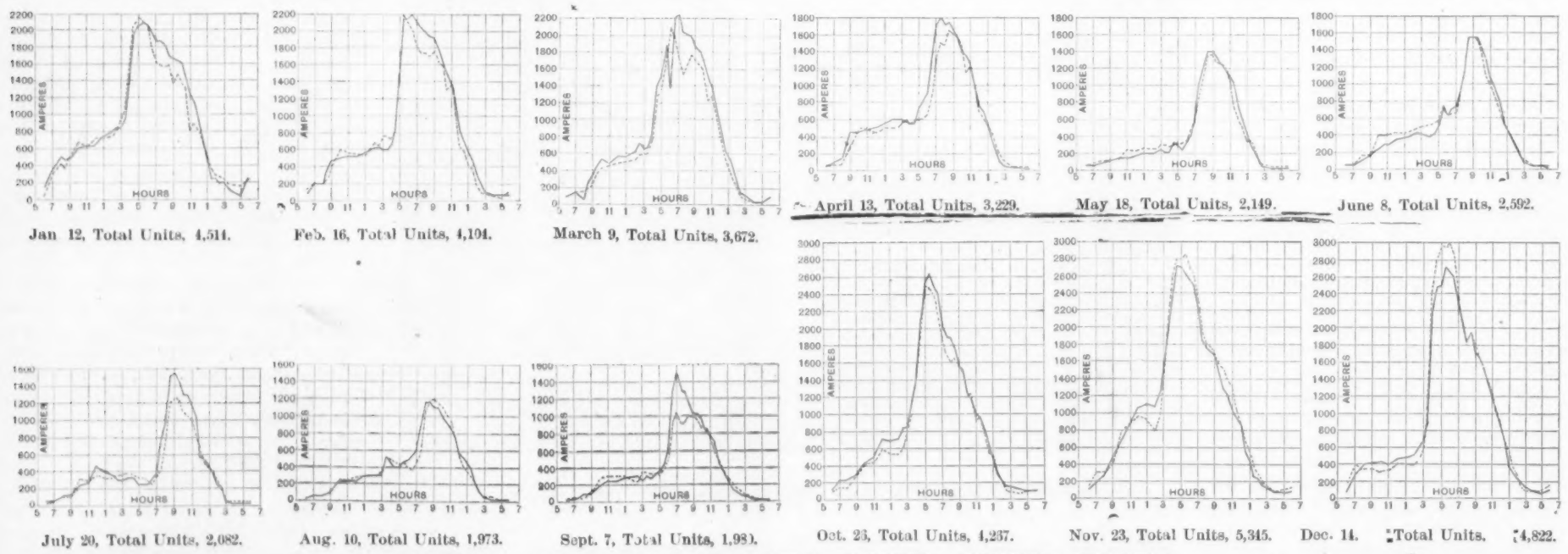
Humboldt's observations in the same line were continued for many years, notably between 1805 and 1806, in company with Gay-Lussac during a tour which they made together through France, Switzerland, Italy and Germany.

At request of the King of Prussia, Humboldt returned from Paris to his native city in 1827, and it was during the winter of 1827–1828 that he began in Berlin his lectures on "Cosmos," or "Physical Universe," the title of his chief work, which has universally been recognized as one of the greatest scientific productions ever published.

See Klenke, "Alex. Von Humboldt, ein biographisches Denkmal," 1851: "Alex. Von Humboldt . . . von Wittwer," Leipsic, 1861; Gren's "Neues Journal der Physik," vol. IV.; *Annales de Chimie*, vol. XXII.; *An. Chim. et Physique*, vol. XI.; Poggendorff's "Annalen," vols. XV., XXXVII.; "Société Philomathique." Tome I., p. 92; "Opus. Scelti," XXI., p. 126; Knight's "Mech. Dict.," vol. II., p. 1874; *Sc. Am. Supp.*, No. 457, pp. 7,301, 7,302; Noad, "Manual," pp. 425, 528, 529, 612; Harris, "Rudim. Magn.," Part III., p. 103; Walker, "Ter. and Cos. Magn.," 1866, p. 81; Humboldt, "Aphorismi ex doctrina . . . ," 1793, "Voyage, etc., dans les années, 1799–1804"; "Report of Seventh Meeting of British Association," vol. VI.; London, 1838, pp. 1, 5 and 7, and the remainder of Major Sabine's able article upon "Magnetic Intensity," in the same volume; Report of the Meeting of the French Academy of Sciences, of May 21, 1849, for extract of a letter from Emile H. Du Bois-Reymond, sent by Humboldt, and treating of the Electricity of the Human Frame ("L'Institut," Mai 23, 1849); S. H. Christie and Sir G. B. Airy, "Report upon a Letter . . . ," London, 1836; C. H. Pfaff, "Mém. sur les expér. de Humboldt . . .," 1799.

Sample Load Curves of Central Stations.

We reproduce herewith from *The Electrician*, London, some load curves, which it is said may be taken as typical of observation, which was originally made at the commencement of 1796, surprised Humbold, so much that he instantly communicated it to Soemmering, Blumenbach, Herz and Goethe. He had not as yet found recorded in the published works on galvanism any experiment the result of which had the smallest analogy with his discovery; and it was not until after the publication of the works of Pfaff on animal electricity that he became acquainted with any one similar to his own. There were, however, some differences, as he proves by several passages cited from the above author.



Jan 12, Total Units, 4,514. Feb. 16, Total Units, 4,104. March 9, Total Units, 3,672. April 13, Total Units, 3,229. May 18, Total Units, 2,149. June 8, Total Units, 2,592.

July 20, Total Units, 2,082. Aug. 10, Total Units, 1,973. Sept. 7, Total Units, 1,981. Oct. 25, Total Units, 4,237. Nov. 23, Total Units, 5,345. Dec. 14. Total Units. 4,822.

SPECIMEN LOAD CURVES OF CENTRAL ELECTRIC LIGHTING STATIONS.

Volta having singled out the differences, in point of savor, which result from galvanic experiments on the tongue, according to the nature and disposition of the coatings, Humboldt repeated these experiments and added to them several of his own, with a nearly similar result. His different trials, however, having failed to produce any contraction of the tongue, appear to have established the truth of the ancient assertion of Galen, confirmed by Scarpa, namely, that the nerve with which the tongue is supplied by the third branch of the fifth pair is exclusively devoted to the sense of tasting, and that the ninth pair are exclusively destined for the motion of the tongue.

The eleventh chapter of Wilkinson's work contains the analysis of the report drawn up by Mr. J. N. Halle in behalf of the commission appointed by the French National Institute. This commission, which was organized to look into (*examiner et vérifier*) the different galvanic experiments which had been made and to ascertain their effects and results, was composed of such distinguished French

the demands made upon the St. James company's station for each month during the past year. The first diagram is deduced from the last twelve, and is typical of the *total* units generated in any one month of the year. The difference between the average demand in July and in November is very instructive; and in the case of the St. James company, the additional lamps connected to the mains in the interval being insignificant, the November increase may be taken as due solely to climatic and meteorological conditions. The ample dimensions of the area enclosed by the second curve, which refers to Tuesday, Dec. 22, 1891—a day of fog and darkness—may be contrasted with the last diagram of all, which shows a curve typical of the normal state of things in December. The full lines on the sample monthly curves show the current going out on one main and the dotted lines give the current going out on the other main, so that the ordinates have to be added together to obtain the total output. The even balancing of the two circuits is worthy of notice.

On the Relation Between Rise of Temperature and Current in Electric Conductors.—I.

BY F. L. O. WADSWORTH.

In THE ELECTRICAL WORLD of July 4, 1891, there appeared a diagram representing the relation between rise of temperature, current and diameter of wire. The general plan on which the diagram is arranged is admirable, inasmuch as current and temperature are the continually varying factors which are met with in practice, diameters being limited to certain standard sizes. The idea is not new, however, as Kennelly* expressed the results of his experiments on the heating of wires in the same manner, experimental curves being given showing the relation between temperature and current for each particular size of wire. In his final diagrams he expressed C as a function of diameter for particular temperatures, probably because this relation is, in the formula which he proposed, a little more readily expressed mathematically.

In Mr. Fay's diagram the relation between current and rise of temperature for a wire of any size is expressed by a straight line $C = A\ t$.

In view of the results obtained by all previous experimenters it seems impossible on experimental, as it also does on theoretical, grounds, that this relation represents the case with any approach to accuracy for either insulated or bare wires, whether incased in moldings or suspended overhead.

Before further considering this point it may be well to notice two more mistakes which Mr. Fay makes.

The scalar relations between abscissæ for lamps of different voltages is not quite correct, as Mr. Fay himself points out; the error is, however, comparatively unimportant. The scalar relation between ordinates for the different thermometric scales is entirely wrong.

It seems almost unnecessary to state that the ratio between a degree F. and a degree C. or R. is always as 1 to 1.8, and as 1 to 2¼ respectively. Independently of the correctness of the law, it would be quite uncertain as to which column of temperatures was to be used as correct.

If Mr. Fay has made any experiments on the subject it is unfortunate that he has not given them in his article—more unfortunate still that he makes no statement as to what data he uses in deducing the relation which he assumes. In the absence of any such experiments it will be necessary to consider only the results obtained by other experimenters, and from them deduce the best empirical relation between current and rise of temperature in any particular conductor, afterwards comparing the result so obtained with that deduced from theoretical considerations.

The reverse process would perhaps be most logical did I not wish to emphasize the fact that the relation found has a strong experimental basis as well as a theoretical one.

The objection may be raised that some of the experiments considered were made upon bodies of a different form than those with which we have to deal in this case—long, thin wires, or made under different conditions than those met with in practice.

In answer to this it may be said that the experiments of Kennelly were made under exactly the conditions which arise. The objection is not really valid, because, as we shall shortly show, experimental results indicate, as we

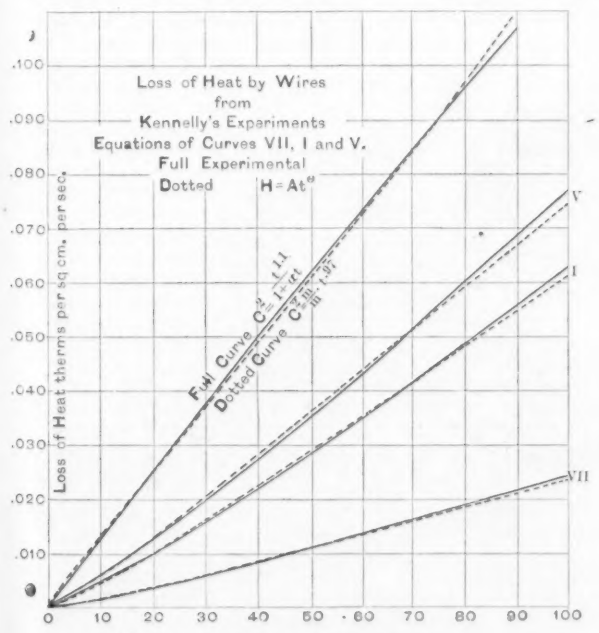


FIG. 1.—LOSS OF HEAT BY WIRES.

should expect, that the law of cooling in gaseous media is general and nearly independent of the form of the body and the conditions of its surface, these conditions affecting only the value of the constants which enter into the relation.

As regards the question of bare and insulated wires, for example, parallel experiments by Kennelly show very conclusively that the general form of the relation between temperature and current remains the same, only the constants of the formula changing, as they should, with the extent of surface and the character of the surface presented to the air.

A mere inspection of the experimental relations between temperature and current is sufficient to show that the relation between them is parabolic, certainly not linear. The empirical equation of relation can be deduced directly from these experimental curves, and it has been found that an equation of the form $C = A\ t^{\theta}$, where A is a constant for any one conductor and θ is a number not far from 0.5, represents them very closely.

It will be more convenient in deducing this relation to proceed in another way, as by so doing another point of interest is brought out and the general value of θ is more easily determined. It has been proven experimentally by the experiments of Forbes and Kennelly that the total amount of heat lost by a wire carrying a current or otherwise heated above the temperature of the surrounding air is very nearly proportional to the temperature, and the experiments made by McFarlane and Nichol on metal spheres point to the same result. Indeed, this is no other than Newton's law of cooling, which has long been accepted as nearly correct for small differences of temperature.

Forbes' assumption, therefore, that the loss of heat (which we will call H) per square centimetre per second is directly proportional to the difference of temperature t between the air and the wire is very nearly correct, at least for temperatures less than 100 degrees C., for a conductor of any given size. The great error in the formula which he gives for the relation between C, D and t is due to another assumption, viz., that in different conductors at the same temperature elevation the loss of heat is directly proportional to the surface.

There is a slight departure from the law of simple proportionality between H and t which may as well be taken into account. If we consider first McFarlane's results we find that for a copper sphere the value of H at different temperatures, 0 to 60 degrees C., is expressed by the following empirical formula, which represents very closely indeed the results of experiment:

$$(A) \quad H = .000168\ t + .00000198\ t^2 - .000000017\ t^3.$$
$$(B) \quad H_1 = .000238\ t + .00000306\ t^2 - .000000026\ t^3.$$

where H is for bright (polished) copper and H_1 for blackened copper.

In Table I. column (1) are given the values of H as calculated from this formula for different temperatures up to 60 degrees. As the formula represents a parabolic curve, it ought to be possible to express the relation between H and t in the form $H = At^{\theta}$, which, symbolically, at least, is very much simpler than the one just given. Assuming, therefore, this relation $H = At^{\theta}$, the most probable values of A and θ were determined by the method of least squares from the seven observation equations obtainable from Table I.

As this method is repeatedly used in this paper it may be well to give a brief outline of the process.

Taking logarithms of both sides we have

$\log A + \theta \log t = \log H$. For the seven values of t given in Table I. we have therefore the seven equations: *

(1) $\log A + \theta\ .699 = -.0506$
(2) $\log A + \theta\ 1.000 = .2695$
(3) $\log A + \theta\ 1.301 = .6040$
(4) $\log A + \theta\ 1.477 = .8035$
(5) $\log A + \theta\ 1.602 = .9445$
(6) $\log A + \theta\ 1.699 = 1.0512$
(7) $\log A + \theta\ 1.778 = 1.1342$

Combining these seven equations by the ordinary method of least squares, we obtain the two normal equations,

$$7 \log A + 9.556\ \theta = 4.7565$$
$$9.556 \log A + 13.977\ \theta = 7.5228$$

from which to determine the best values of $\log A$ and θ, and which give $\theta = 1.103$. $\text{Log } A = \log 1{,}000\ A = -1.1738$. $A = .0001492$.

By a precisely similar process we find in the case of blackened copper, by using the figures of the first and fourth columns of Table I. the normal equations.

$$7 \log A_b + 9.556\ \theta_b = 5.862$$
$$9.556 \log A_b + 13.977\ \theta = 9.043$$

Whence

$\theta_b = 1.118$ and $\log .1000\ A_b = -1.3112$. $A_b = .0002048$.

The values of H as determined from these values of θ and A by the formula $H = At^{\theta}$ are given in the columns marked (2), Table I. A comparison of the curves is also given in Fig. 1, the full line curves being calculated from McFarlane's formula, the dotted line curves from that just deduced. It will be seen that the agreement is very close and well within the limits of experimental error, as a reference to the original data of experiment will show.†

At temperatures higher than those given in the table there is no doubt that the formula $H = At^{\theta}$ represents the truth more closely than that of McFarlane, which indeed makes the loss negative at temperatures above 173.5 degrees C.

The loss of heat H is in calories per square centimetre per second and the excess of temperature, t, in degrees C. Temperature of air about 14 degrees C.

Kennelly has given the results of seven experiments, three on metal strips and four on wires, all suspended overhead, in which the total loss of heat per lineal centimetre is expressed directly as a function of the temperature. One of the experimental curves for the strip and three of those for the wires of different sizes have been taken, and assuming their equations to be the same as before $H = At^{\theta}$. A and θ have been determined.

For convenience in comparison with the results of McFarlane's experiments the emissivity is expressed in terms of H instead of watts per linear centimetre, as originally given.

TABLE I.

Temp. degrees C.	Bright copper. (1) $H = At + Bt^2 - Ct^3$.	Bright copper. (2) $H = At^{\theta}$.	Blackened copper. $H = A't + B't^2 + C't^3$.	Blackened copper. (2) $H = A_1 t^{\theta}$
5°	.000890	.000881	.00126	.00124
10°	.00187	.00189	.00266	.00269
20°	.00402	.00406	.00578	.00583
30°	.00636	.00635	.00918	.00917
40°	.00880	.00873	.01276	.01266
50°	.01125	.01116	.01630	.01624
60°	.01362	.01364	.01968	.01991

The data of the experiment are as follows:

Experimental curves from Fig. No. 6, in THE ELECTRICAL WORLD, XIV., No. 23:

Conductor No. VII. Bright strip supported at each end, 2.54 centimetres broad, $B = .0469\ A$.

Conductor No. 1. Bright wire supported at each end, .3416 centimetre diameter, $B = .224\ A$.

Conductor No. II. Bright wire supported at each end, .279 centimetre diameter, $B = .272\ A$.

Conductor No. 5. Bright wire supported at each end, .514 centimetre diameter, $B = .514\ A$.

A New Elevator Controller.

The illustration shows a new controlling rheostat for use with electric motors for running elevators, hoists, and in other places where the conditions require that the motor be started, stopped and reversed continually. It consists of a resistance box of special form, as shown in the cut. By the movement of a lever, resistance can be gradually thrown in or out of the motor circuit as required, thus increasing or diminishing the speed of the motor. The lever also carries the contacts required for reversing the motor. This controller can be employed, it is stated, with either shunt or series wound motors, and has an arrangement whereby, before the motor can be reversed, the whole resistance is thrown into the armature circuit. By this means the possibility of burning out the armature by too sudden reversal of the motor is prevented, and fluctuations in the voltage of the line wires by too swift an accession of power is reduced to a minimum. It is constructed to carry continuous currents of 15 ampères with all the resistance in circuit, but it is claimed that currents up to 60 ampères can be passed through it for a short time without injury, when starting the motor. The contact lever can be worked by a handle or a pulley wheel, as conditions require. For elevator work it is fitted with a pulley, around which passes the steel rope, which, in the hands of the elevator man, controls the movement of the elevator. The resistance consists of a continuous series of sheet iron convolutions, with mica insulation between the same, divided into sections, each of which is connected to a vertical brass bar arranged around the iron convolutions, so that a special contact shoe on the lever arm makes a perfect frictional and flexible contact with the brass bars, and the lever operating this contact shoe works over a slate table fitted with brass rings for the main and armature connections,

EDISON ELEVATOR CONTROLLER.

in which carbon contacts are used. As iron, brass and mica are the principal materials used in the construction of the controller, it is claimed that it will withstand a very high degree of heat, without risk of destruction. A space 2 feet 2 inches square and 1 foot 10 inches high is required for the controller. It is designed to take the place of the older motor rheostat, manufactured by the Edison General Electric Company, and it is expected that its novelty of form and the advantages claimed for it will bring it into considerable requisition in places where the older and more cumbersome styles have hitherto been used, and that it will be an essential feature in the installations of electric elevators or hoists.

*THE ELECTRICAL WORLD, Vol. XIV., Nos. 22 and 24.

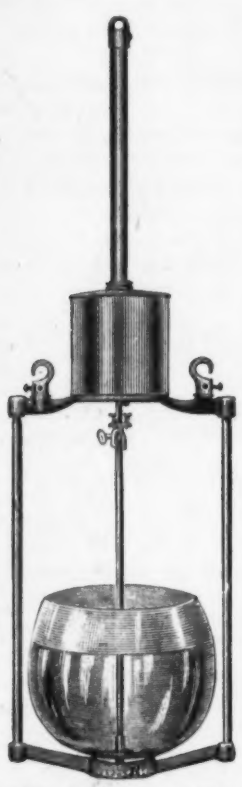
* Both sides of the equation are multiplied by 1,000 to avoid negative logarithms.

† Surface conductivity for heat in absolute measure. McFarlane, Proc. Royal Soc., 1872, p. 93.

A New Arc Lamp.

The arc lamp shown in the illustration is designed to burn on either arc or incandescent circuits.

It is ornamental in appearance and apparently simple in construction, and is fitted with hand cut-outs, automatic cut-outs and automatic short circuit, which remove all resistance, as well as the lamp, from circuit when the carbons are consumed, and which allows single and "twin" carbon or all-night lamps being operated on the same circuit with perfect safety. The frame of the lamp is wide and was especially designed, it is stated, to overcome an objectionable feature so often noticed in lamps, that of casting large shadows. It is said to be perfectly insulated, and can be handled with safety when in circuit. The carbons are fed by a train of gears that are controlled by differential magnets, which cause a uniform feed and consequently a steady, noiseless, white light. These gears are connected so as to allow a rapid upward movement of the feed rack to facilitate trimming. They do not stick when constantly exposed to the weather, preventing the carbons from feeding and cause the extinguishment of the lamp. It is easily adjusted to any length arc desired, and is made in two different styles, single and twin carbon. Both styles are made to give a light of either 1,200 or 2,000 normal c. p., and the twin carbon lamp is practically the same as the single carbon with the exception of a carbon holder. It is manufactured by the Duplex Electric Company, Limited, of Corry, Pa.

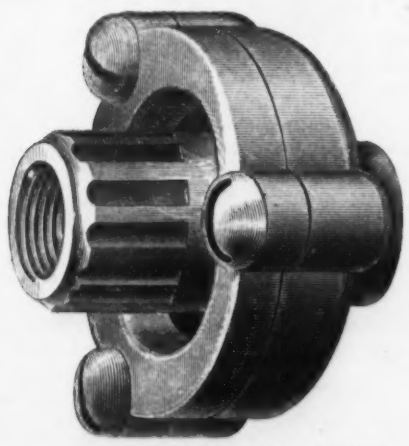


DUPLEX ARC LAMP.

The Gleason Insulating Joint.

We show in the illustration an insulated joint which has been brought out by the E. P. Gleason Manufacturing Company, of New York. It is designed to meet the demand for a good, substantial insulating joint, and it has been decided to make the chandelier fitting of galvanized malleable iron.

The Gleason joint is composed of a cupped flange which incloses the insulation, and the screws which secure the parts together enter into solid metal, having no hard rubber or other bushings under the head. There is no possibility, it is claimed, of rupture or strain, either when hanging the fixture or in after use. It is sold by all the prominent electrical companies, such as the Thomson-Houston, Westinghouse, Sawyer-Man and others, and by nearly all the supply houses in this country and Europe. Of the large number in use, not one, it is stated, has ever been known to short circuit, leak gas, or in any manner get out of order.

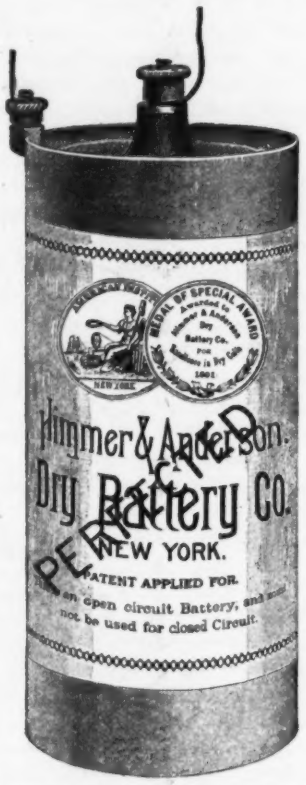


GLEASON INSULATING JOINT.

The "Perfected" Dry Battery.

The dry battery has of late been brought into prominence on account of the many advantages obtained in bringing into service a battery in which no liquid is employed, in comparison with that in which a solution is used. We show in the illustration a battery of this type which has been brought out by the Himmer & Anderson Dry Battery Company, of 123 Chambers street, New York. It is known as the "Perfected" dry battery.

A circular cell of the type, measuring 3 inches in diameter and 7½ inches high, in a recent test, showed, it is stated, an E. M. F. of nearly 1.8 volts, and on short circuit gave no less than 11 ampères, holding its E. M. F. and current for some time, with complete recovery after a short rest. Arrangements have been made with the manufacturers to furnish these cells in large quantities and in a number of sizes, and they can be used in many classes of work where a liquid battery could not be employed. Mr. A. E. Kornfeld has recently assumed the business management of the Himmer & Anderson Company, and will hereafter assist in effectually presenting the advantages of the "Perfected" dry battery to the trade.

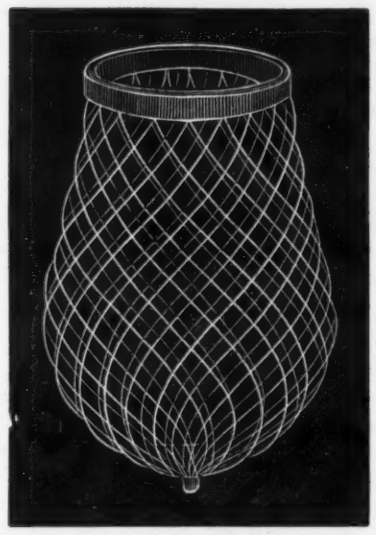


PERFECTED DRY BATTERY.

An Incandescent Lamp Protector.

The extraordinary growth and development in electric lighting, and especially the use of incandescent lamps, has brought out many devices for the proper handling and protection of these lamps in places where there is likelihood of their being easily broken. The illustration shows one of these devices which has been brought out and is manufactured by the Weston & Wells Manufacturing Company, of Philadelphia. It is designed for use in factories, machine shops, cellars, storehouses—in fact, in connection with any business or in any place where there is risk of breakage in the use of incandescents.

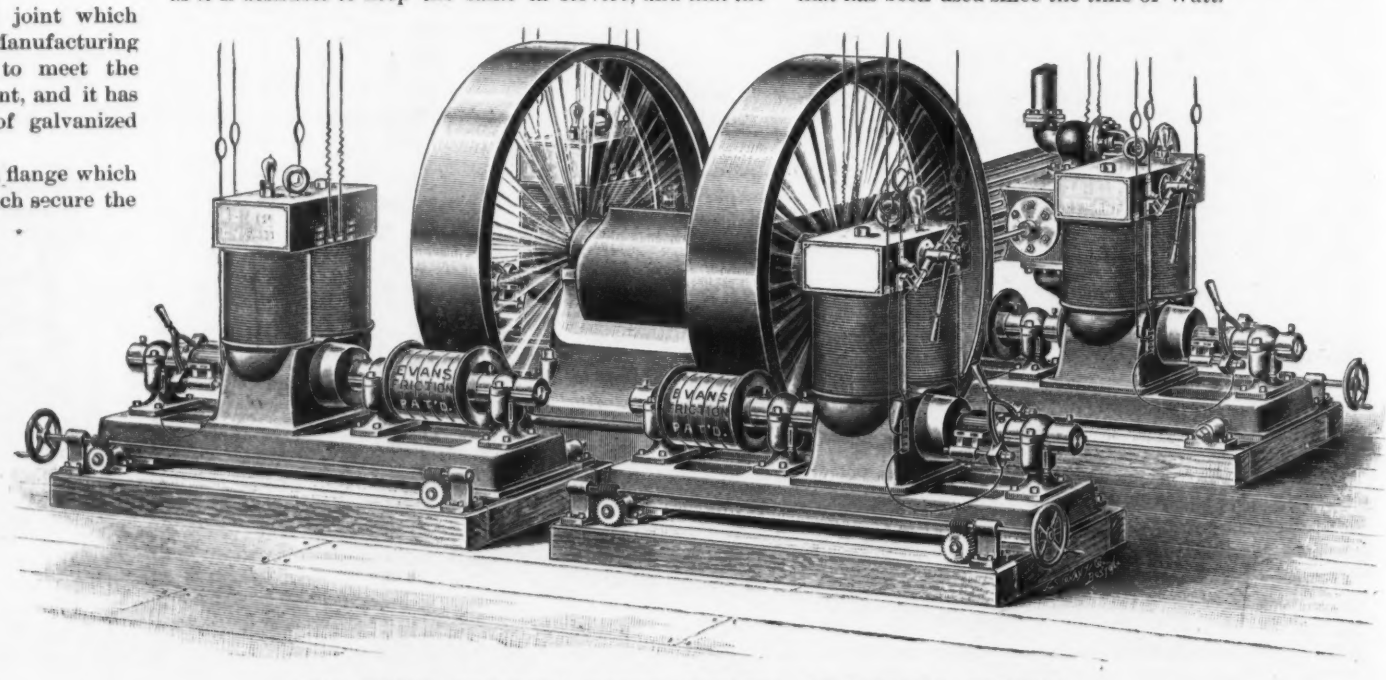
It is also being extensively used in mine service, and is regarded as exceedingly well adapted for such purposes. It is stated that a lamp protected by it will "live" as long as it is desirable to keep the same in service, and that the possibility of breakage is reduced to the minimum. The principle involved and design of the protector can be readily seen from the illustration.



INCANDESCENT LAMP PROTECTOR.

The Evans Friction Cone.

We show in the illustration an application of the friction cone in connection with dynamo work as practically in use in the Weeks Building, in Boston, where four Edison dynamos are driven by the Evans friction cone system in connection with a 200-h. p. McIntosh & Seymour engine. The method of application can readily be seen from the illustration. The advantages claimed for this system are, among others, economy in room and the convenience of operating each dynamo separately. It is stated that wherever these cones are being used they are giving perfect satisfaction. They are manufactured by the Evans Friction Cone Company, of 85 Water street, Boston, Mass.



THE EVANS FRICTION CONES APPLIED TO DYNAMO DRIVING.

Condensing Apparatus.

There is no position in which machinery undergoes such severe strains, or is called upon for such constant service, as in electric light and railway power stations. As the question of steam economy receives more and more attention, engines of higher class are used, and large stations are rarely equipped in which compound or triple expansion engines are not used. The value of condensing apparatus in connection with these engines is so considerable that it is employed wherever water for condensing purposes is obtainable. This result has been reached with considerable tardiness on account of the unsatisfactory experience that engineers have had with the type of air pump and condenser that has been used since the time of Watt.

THE WORTHINGTON CONDENSER.

Appreciating the necessity of a condensing apparatus of absolute reliability, Henry R. Worthington, of New York, has made this class of machinery a subject of special study, and in the Worthington condenser, an illustration of which appears on this page, it is believed that all important features have been combined. This machine employs the duplex steam valve motion. There are no dead centres and the pump has the regularity of motion that is characteristic of duplex pumping machinery. This insures a steady vacuum. The whole construction is very compact

and substantial. The water pistons are always sealed with water and travel in cylinders lined throughout with composition. The injection water as it enters the condenser is broken up into fine spray by means of a spraying device which can be readily cleaned without stopping the machine. Any air which may enter with the water or the steam is entrapped by the spray and carried into the pump thoroughly commingled with the water. The pump is thus supplied with a homogeneous fluid, consisting of thoroughly mixed air and water, and not, as in the ordinary air pumps, separated air and water.

The construction of the condensing chamber is such that the velocity of the incoming water and steam tends to assist the pump in its action, and it is worthy of note that the vacuum in the water cylinders of this machine is less than that maintained in the exhaust piping. This is quite the opposite from the usual practice with old-fashioned air pumps, in which latter case the vacuum in the pump cylinders must necessarily be greater than that maintained in the exhaust piping.

These condensers have been built of very large size and cases may be cited where they have been run day and night for several months without stopping. Frequently two or more engines are exhausted into one condenser, and when the engines are not all in use a less amount of injection water is required and the speed of the pump is correspondingly reduced.

The superior advantage of this machine in comparison with dependent or attached condensers can be shown in no better way than by the actual results obtained, where they have displaced attached condensers. In such cases not only is a higher degree of vacuum maintained by the Worthington condenser, but the engine is relieved of the load of the air and water pumps, which enables it to furnish just so much additional power at the driving belt.

The Worthington condenser can be started before the main engines, so as to free the engine cylinders and piping from condenser water and assist the engine by the vacuum in starting.

If the exhaust steam from the condenser pump and boiler feed pump is conducted to a supplementary heater through which the feed water passes on its way to the boilers, it will be all condensed and its heat imparted to the feed water, thereby materially increasing the temperature above that of the hot well. As the exhaust steam from the pumps is in this way completely condensed and the heat returned to the boiler, it is obvious that the cost of operating the condenser and producing the vacuum is reduced to a purely nominal figure.

These condensers have been very successfully applied to some forty or fifty compound and triple expansion marine engines on steamers of the Great Lakes plying between Buffalo and other lake ports.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Feb. 20, 1892.

The speculative interest in the stock market this week, has been more evenly diffused than for some time past, and no one group of stocks has monopolized the business of the exchanges, as was the case during negotiations for the deals of the electric and later of the coal companies. With this more evenly divided interest we notice a general strength throughout the entire market and an increase in price of nearly all the stocks of from one to two points. The general conditions of the financial world are now in all respects favorable to a strong market, and with an abundance of money the investors are ready and willing to place their funds in the conservative securities, and business on the part of the broker and the investor is of a most satisfactory character. Security and confidence is felt on all sides, and neither the bear element, nor the excited bull element is prevailing at present. The intense excitement which prevailed during the close of the deal between the coal companies last week was short-lived, and in a short time served its purpose, both legitimate and speculative, to attract for a time all the business of the market to a few stocks. Previous to that the electric companies' deal was of absorbing interest, and that too has now reached a quiet condition, and the stocks are selling on a strong but only moderately active basis. The preliminary details of the combination have been settled, and matters are rapidly progressing toward an exchange of the stocks of the Edison and Thomson-Houston companies, and in a very few months business will be carried on under the new regime. There is a great deal of speculation and inquiry as to what is to become of the smaller manufacturing companies in this deal between the two larger ones. The stockholders of the Westinghouse, Fort Wayne, Detroit and others are wondering what is to be the position of these companies toward the consolidated company, and in what light their stocks will be regarded in the future. There will be such a large amount of stock left unissued in the treasury of the consolidated company that it will provide ample means for taking care of these interests and all future ones, whose accession would be valuable. The success of the consolidation plan, as already published, would seem to be assured beyond a doubt, since more than a majority of the stock of both companies has assented to the plan by the stockholders subscribing to the agreement. The organization has not yet been made, but may be looked for soon.

About the only disturbing element in the market at present, but which is nearly counteracted by the strength and buoyancy of the market, is the pending settlement of the legislation on silver coinage. Although there will be more or less uneasiness on this point, until the matter is finally settled, still its influence has not yet been materially felt on the market. Foreign markets have been making large sales of securities on this side, and are therefore receiving large remittances for their stock, which employs considerable money.

In the money market the commodity continues to be very abundant, but there is an active demand for it and prices are very firm. The rates between banks has been from one and one-half to two and one-half per cent. Choice business paper can be placed as low as three and one-half per cent, and from that up to 5 per cent.

The sales this week show about 9,000 shares of Thomson-Houston, varying from 61⅛ to 59⅛; 8,000 shares of Edison, varying from 102 to 100; 4,000 shares of Fort Wayne at from 14 to 13⅛. These figures show a decided strength in the electrics with a moderate activity in sales, though a little weakness developed toward the end of the week.

Bonds.—Coupons of the first mortgage seven per cent. bonds of the San Antonio (Tex.) Street Railway Company (electric) are now payable at the office of the Atlantic Trust Company, 39 William street, New York.

Thomson-Houston.—The governing committee of the Boston Stock Exchange has placed on the list the trust company's receipts for stock deposited of the Thomson-Houston common and preferred.

Increase in Capital Stock.—The Lebanon (N. H.) Electric Light and Power Company has increased its capital stock from $12,000 to $18,000; the stockholders of the St. Louis (Mo.) Electric Power Company will meet May 2, 1892, for the purpose of voting upon the propositions to increase the capital stock of the company from $30,000, its present cash capital, to $75,000, and to change the name from St. Louis Electric Power Company to St. Louis Electric Light and Power Company; the stock of the Peninsula Electric Light and Power Company, of Houghton, Mich., at its annual meeting was divided into 3,000 shares of the par value of $25 per share. The report of the treasurer showed that $25,000 of the net earnings had been invested in enlarging the plant, and the stock was increased to 4,000 shares of the par value of $25 per share, and divided pro rata among the stockholders as a dividend. The company has now reached a dividend basis, and will hereafter, we are informed, pay a semi-annual dividend of four per cent.; the charter of the Narragansett (R. I.) Electric Light Company has been amended so as to permit of an increase in capital stock.

Decrease in Capital Stock.—The Wheaton (Ill.), Electric Light and Water Company has certified to a decrease of capital stock from $20,000 to $15,000; the Lakeside Electric Railway Company, of Peoria, Ill., has certified to a decrease in capital stock to $8,000.

Dividends.—The Southern Massachusetts Telephone Company is paying a quarterly dividend of two per cent.

Annual Reports.—The annual report of the American District Telegraph Company for 1891 shows: Gross earnings, $502,769; expenses, repairs and construction, $471,421; net earnings, $31,348; miscellaneous income, $13,938; total net, $45,287; dividends paid, $51,000; deficit, $5,713; total cash balance, Dec. 31, 1890, $34,272; cash balance, Dec. 31, 1891, $28,559. Capital stock, $3,000,000, of which $450,000 is in the treasury; other stocks and bonds in the treasury, $232,500; miles of wire in operation, 689½; offices, 62; instruments, 18,911; messengers, 1,075; other employés, 88. The negotiations for the purchase of the entire capital stock of the Mutual District Messenger Company, Limited) 300 shares, par value $25 each, $7,500), and the Mutual District Telegraph Company (3,000 shares, par value $100 each, $300,000), including their respective properties, franchises and privileges, which were in progress at the close of the fiscal year 1891, were completed Jan. 12, 1892, as stated in THE ELECTRICAL WORLD, by the exchange of 12,750 shares of the capital stock of the American Company, which was duly provided for by the increase of its capital stock from $3,000,000 to $4,000,000, and the capital stock of those companies is now in the treasury of this company, and their organizations are within its control.

Closing Quotations.—The following were the closing quotations of electric stocks on Saturday, Feb. 19, 1892, in New York and Boston:

NEW YORK QUOTATIONS.

Name of Stock.	Par.	Capitalization.	Bid.	Ask'd.
Western Union Telegraph Co.	100	86,200,000	88½	88⅝
Commercial Cable Co.	100	7,716,000	149	150
Edison General Electric	100	15,000,000	99¼	99¾
Consolidated Electric Light	100	2,500,000	20	30
Edison Illuminating Co., of New York	100	4,500,000	81½	82
" " " Brooklyn	100	750,000	74	78½
" " " Chicago	100	750,000	138	142
U. S. Illuminating Co.	100	1,250,000	30	35
Edison Elec. Light Co. (of Europe) stock	100	2,000,000	2½	5
" " " bonds	sh	30,000	65	75½
" Ore Milling Co	100	2,000,000	17½	22½
" Toy Phonograph Mfg. Co	10	1,000,000	....	½
U. S. Electric Light Co.	100	1,500,000	15	20
Brush Illuminating Co., of New York	50	1,000,000	40	50
Mt. Morris Electric Light Co.		500,000	....	60
East River Electric Light Co.	100	1,000,000	....	60
North American Phonograph Co.	...	6,600,000	4½	6
New York Phonograph Co.	...	2,000,000	3	4
Automatic Exhibition Co.	...	2,000,000	2	2½
New England Phonograph Co.	...	2,000,000	1¾	2¾

BOSTON QUOTATIONS.

	Par.	Capitalization.	Highest.	Lowest.	Bid.	Ask'd.
Thomson-Houston Elec.	25	6,000,000	61⅛	59⅛	59¾	60
Thomson Houston Elec. preferred	25	4,000,000	29	28¼	28¼	28½
Thomson-Houston Elec.—Series C	sh	40,000	....	....	8⅛	9
Thomson-Houston Elec.—Series D	sh	120,000	7¾	7½	7¾	8
Thomson-Houston Int'n'al Elec.	100	600,000	....	....	200	210
Thomson-Houston Int'n'al Elec—Pfd	100	400,000	....	....	101	103
Thomson Elec. Weld.	100	1,000,000	55	....	55	....
Thomson European Elec. Weld	100	1,500,000	....	....	12½	15
Westinghouse Elec.—Pfd.	50	10,000,000	25	....	24½	25
Westinghouse Elec. — Trust receipts	..	.....	16	14½	15¾	16
Fort Wayne Elec.	25	4,000,000	14	13⅜	13⅞	14
Fort Wayne Elec.—Ser A.	sh	80,000	7¼	....	7⅛	7¼
Detroit Elec	10	1,000,000	8	....	8	8¼
West End St. Ry. Co.—Com.	50	7,150,000	74	73	73	73¼
West End St. Ry. Co.—Pfd	50	6,400,000	84¾	....	84¾	85
American Bell Tel.	100	15,000,000	209⅛	....	209	210
Erie Tel. & Tel. Co.	100	.....	45	....	45	....
Mexican Tel. Co.	..	.....	110	....	105	110
New Eng. Tel. & Tel. Co.	100	.....	52	....	51	52
Tropical Tel. Co.	..	.....	....	....	...	50

*Ex-dividend

Chicago Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on electrical stocks as follows:

TELEPHONE STOCKS.

Chicago	$230@	$232	Cumberland $60@ $62
Central Union	56@	57	Wisconsin 118@ 120
Michigan	81@	83	Bell of Missouri 175@ 180
Great Southern	30@	32	Iowa Union 20@ 22
Colorado	34@	36	Missouri & Kansas 51@ 53
Rocky Mountain Bell.	40@	43	

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$87@	$89	Chicago Edison Co. $155@$165

NEW INCORPORATIONS.

The Milton Electric Light and Power Company, of Milton, Pa., capital stock $40,000, has been formed to manufacture and supply light and power by electricity in Milton. Ed. Mullan, Frank Phue, both of Philadelphia, and Levi E. Snow, of Milton, Pa., are those interested.

The Knightstown Electric Light Company, of Knightstown, Ind., capital stock, $10,000, has been organized to operate and maintain an electric light plant, furnish motive power, etc. Geo. W. Williams, John S. Patterson, S. E. Test and Harry Watts are the incorporators.

The Central Electric Light and Power Company, of Chicago, Ill., with a capital stock of $500,000, has been formed to manufacture, sell, rent, etc., light, heat and power produced by electricity, etc. A. T. McDonald, W. H. Harding and W. J. Buckley are the promoters.

The Washington Street Railway Company, of Washington, Ind., capital stock $50,000, has been formed to build, maintain and own an electric railway and electric power and lighting system. Hos. Wilson, Oscar Kahn, Robt. N. Van Dorn, Sam'l H. Taylor and Wm. W. Marmaduke are the promoters.

The Lower Chichester Electric Light, Heat and Power Company, of Lower Chichester, Pa., capital stock $1,000, has been formed to supply light, heat and power by electricity to the public. Jno. H. Kerwin, of Linwood, Pa.; Thos. H. Berry, of Chester, Pa., and H. F. Walter, of Media, Pa., are the organizers.

Allessandro Town Company, of Allessandro, Cal., capital stock $1,500,000, has been organized to deal in real estate, factories, gas and electric works, etc., etc. The incorporators are Paul C. Skiff, New Haven, Conn.; Geo. H. Talbot, Norton, Mass.; Walter A. Main, A. E. Sterling, E. W. Wilmott, C. E. Fish and E. C. Judson, all of Redlands, Cal.

The Madera Electric Light, Transportation and Power Company, of Madera, Cal., with a capital stock of $100,000, has been formed to build and operate street railways for freight and passengers, electric plants, etc., etc. The promoters are Return Roberts, W. C. Maze and T. A. Ripperdan, of Madera, and A. F. Johns and William Jenningson, of San Francisco, Cal.

The Allessandro Valley Land Company, of Allessandro, Cal., with a capital stock of $1,000,000, has been formed to deal in real estate, gas and electric works, etc. Paul C. Skiff, of New Haven, Conn.; John A. Preston, Walter A. Main, A. E. Sterling, E. W. Sterling and E. W. Wilmot, all of Redlands; Geo. H. Talbot, of Norton, Mass., and E. G. Judson, of Redlands, Cal., are the incorporators.

AFFAIRS OF THE COMPANIES.

Title Changed.—The title of the Southern Electric Company, of Lynchburg, Va., has been changed to The Poole Electric Company.

The Harrisburg (Pa.) Electric Light Company will hold a meeting March 15 for the purpose of voting for or against a proposition to sell and convey its franchises and all its property, real, personal and mixed.

The Louisville (Ky.) Electric Light Company, at a meeting of its directors, elected the following officers for the ensuing year: Harry Bishop, president; George W. Morris, vice-president, and J. H. Gilbert, secretary.

The Pomeroy (Ohio) & Middleport Electric Light Company, at its annual meeting, elected the following directors: Ira Graham, E. S. Trussell, W. A. Race, J. R. Wood and G. N. Gray. Ira Graham was elected president, W. A. Race, secretary, and E. S. Trussell, treasurer and manager.

The Webster Electric Light Company, of Webster, Mass., at its recent annual meeting, elected the following officers: President, N. T. Hulburt; secretary, L. E. Pattison; treasurer, John S. Gould; directors, T. T. Robinson, John Gould, B. B. Murdock, L. E. Pattison and N. T. Hulburt.

The Georgia Electric Light Company, of Atlanta, Ga., at its annual meeting, elected the following officers: H. M. Atkinson, president; J. H. Porter, vice-president; W. S. Garfield, secretary; directors, H. E. W. Palmer, Morris Brandon, J. H. Porter, Burton Smith, G. R. DeSaussure, W. H. Inman, Hugh Inman and H. M. Atkinson.

The Lonaconing Electric Light and Power Company, of Lonaconing, Md., at its annual meeting elected the following officers: President, George W. Clark; secretary-treasurer. J. J. Bell Directors, G. W. Clark, J. J. Bell, R. L. Somerville, Andrew Spier and R. M. Boyd. The reports of the officers showed everything to be in a prosperous condition.

The Milwaukee Telephone Company at its annual meeting elected officers and directors as follows: Henry C. Payne, F. G. Bigelow, B. V. Miller, Chas. Ray, C. G. Stark, Fred Vogel, Jr., and Arthur G. Fuller. The directors re-elected H. C. Payne, president; John D. McLeod, secretary, and F. G. Bigelow, treasurer. F. G. Bigelow was elected vice-president in place of C. H. Haskins, resigned, who has permanently located in New York.

The Holmes Electric Protection Company, for Canada. Ltd., at a meeting in Montreal, elected officers and directors as follows: President, H. C. Roome, New York; vice-president, W. J. Turpin, Montreal; treasurer, Geo. G. Foster, Montreal; secretary, F. E. Brouwer-Archer, Montreal; directors, H. C. Roome, New York; W. J. Turpin, Geo. G. Foster, W. Alex. McKay, Montreal; D. W. Hitchcock, Wm. Verrinder, Wm. G. Roome, New York.

The Pekin Electric Light and Power Company, of Pekin, Ill., a new company, has been fully organized, the stock all subscribed, and work on the plant will begin at once. Following are the officers of the company: Geo. Herget, president; Wm. Weiss, vice-president, F. Shurtleff, secretary; and A. Behrens, treasurer. The directors are Geo. Herget, Fred Schnellbacher, F. Shurtleff, Henry Schwartz, A. Behrens, Wm. Weiss and J. V Graff.

The Thomson-Houston Electric Company, it is stated, is desirous of establishing a general electric station in Duluth, Minn., and in order to effect the same it is reported that a plan is on foot to consolidate the Duluth Electric Light and Power Company and the Hartman Electric Company into one general station, giving each company stock in the new scheme, or by buying up their rights for arc and incandescent machines which they now handle in the territory.

The Worcester (Mass.) Electric Light & Power Company, incorporated under State of Maine laws, has been reorganized as the Quinsigamond Electric Power & Light Company, with capital stock of $10,000, under the laws of Massachusetts. The officers are H. H. Bigelow, president: I. E. Bigelow, treasurer, and E. F. Thompson clerk. The company is incorporated to furnish electric lights and also power for the Foster street extension of the Worcester & Shrewsbury Railway.

The United Fire Alarm and Police Telegraph Company has been formed by the consolidation of the Smith & Brewer Police Signal Company, of New Haven, Conn., the Gaynor Electric Company, of Louisville, Ky., the Union fire Alarm Company, of New York, and The E S Greeley & Co.'s system of fire alarm and police telegraph. Mention was made of the possible consolidation of the above companies in THE ELECTRICAL WORLD of Feb. 20, and, as stated, Mr. E. S. Greeley is president of the new company, and Col. E. M. Graves secretary. It is possible that the factory will be located in Connecticut.

The Annual Meeting of the Central District and Printing Telegraph Company, of Pittsburgh, Pa.—The annual meeting of the Central District and Printing Telegraph Company was held recently, and the reports of the various officers showed that the company is steadily extending its system over the territory embraced in its franchise. It is now operating 63 exchanges, 195 toll stations and 133 branch line stations. It has 2,920 miles of underground wires, 9,625 miles of overhead wires, 3⅝ miles of submarine cable and 1,474 miles of poles. The number of exchange subscribers has increased to 6,729, and there are 1,181 subscribers to whom private lines have been leased. The number of employés in the telephone department is 313. The company has let the contract for a $50,000 switchboard which will be placed in its new building on Seventh avenue, into which the company expects to move on April 1. The earnings for last year increased $11,400, and a 10 per cent. dividend was declared. The board of directors was re-elected as follows: D. Leet Wilson, John E. Hudson, C. Jay French, H. S. Huidekoper, George E. Hall, James Merrihew, C. O. Rowe, George I. Whitney, John L. George.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, Feb. 20, 1892.

Mr. Ernest Hoefer, of Chicago, was a welcome visitor in New York this week,

Mr. C. E. Carpenter, of the Carpenter Electric Heating Manufacturing Company, St. Paul, is in the city.

Mr. F. W. Brady, Room 32, 126 Liberty street, is now representing the Keystone Electric Company in New York and vicinity.

Mr. S. L. Phillips, of the Seneca Falls, N. Y., Electric Railway Company, made us a pleasant call on Wednesday of last week.

Mr. Frederic Nicholls, the successful Canadian editor, central station manager and supply man, passed a couple of pleasant days in New York this week, returning to Toronto on Wednesday evening's limited express.

The State Board of Railroad Commissioners will give a hearing Feb. 24 on the application of the Atlantic Avenue Railroad Company, of Brooklyn, to use the trolley on such of its lines as it has not received permission for.

The Chesapeake and Potomac Telephone Company, of Washington, D. C., will hold its annual meeting at 18 Cortlandt street, Feb. 25, for the election of a board of directors and to receive the annual reports of officers of the company, etc.

The Ansonia Brass and Copper Company is sending out handsomely framed pictures of its factories in Ansonia, Conn., and its New York headquarters at 16 and 19 Cliff street. We have received one of them, and, from an artistic standpoint, acknowledge the same worthy to adorn the walls of any office.

American Institute of Electrical Engineers.—At the regular monthly meeting of Council, held Feb. 16, it was voted that the general meeting of the Institute for 1892 be held in Chicago. This meeting has heretofore been held the third week in May, but the exact date of the Chicago meeting has not yet been fixed upon.

The Brush and United States Illuminating Companies and the United Electric Light and Power Company have reported to Mayor Grant that all their wires and poles in Broad way have been removed, and with the exception of three blocks where there are fire wires, Broadway is now clear of overhead poles and wires.

Removing the Poles and Wires.—The Board of Electrical Control since Jan. 1 in its report shows that the Department of Public Works has removed 127 poles and 177 miles of wire, and the companies have removed 286 poles and 563¼ miles of wire. Permits for 41 electric lamps, 7 reset poles and 8 signal wires have been granted, but none for the erection of new poles.

Mr. J. Stanford Brown, the well known engineer, of this city, has joined the staff of The Electrical World, and will devote himself to looking after the business interests of the paper. Mr. Brown is a graduate of Columbia College, and brings to his new position a ripe practical experience in the electrical field, both as an electrical engineer and as a business man.

The Crocker-Wheeler Electric Company will have a full line of motors set up and running during the electric light convention at the office of the Buffalo agents, Messrs. F. P. Little & Company, adjoining the Broezel House. Messrs. Otis Bros. will also have one of their celebrated pumps operated by a ½ h. p. C. W. perfected moter, and their latest Crocker-Wheeler automatic switch.

The Wilder Duplex Electric Burglar Alarm and Messenger Company, incorporated October, 1891, with a capital stock of $500,000, has opened offices at 165-167 Broadway. The officers of the company are Simson Wolf, president; A. M. Sloss, vice-president and general manager, and R. A. Lowenthal, secretary and treasurer. The company will sell rights to different cities to use its fire alarm system.

President Daniel F. Lewis, of the Brooklyn City Railroad Company, was in Pittsburgh last week and visited the Westinghouse works for the purpose of examining the electrical equipment which the company manufactures for street railway work. Mr. Lewis, it is understood, will visit the factories of the Short, Edison and Thomson-Houston companies also, and after his return it is expected that the equipment for the street railway lines in Brooklyn will be decided upon.

The Board of Underwriters, Feb. 18, received the report of the sub-committee appointed to investigate the subject of fires arising from the defective insulation of electric light wires. It was a long document, recommending some radical changes in the manner of stringing electric wires in buildings. The board did not discuss the report, and adjourned without taking any action, but with the understanding that another meeting would soon be called for its consideration.

Mr. Elias E. Ries, President of the Ries Electric Specialty Company of Baltimore, Md., advises us that he has decided to make his headquarters at the Iriquois Hotel during the Buffalo Convention, and an opportunity will be offered to the central station men, etc., to see the Ries Regulating Socket in operation, and to receive a full explanation and all details relating to the advantages claimed for the Reis Regulating Socket for alternating current-incandescent lamps. Visitors to the convention will be interested in this exhibit, as the Reis socket is being extensively used and is very favorably regarded.

To Receive the Electric Light Delegates.—The following local reception committee of Buffalo citizens have been appointed to take care of the delegates to the National Electric Light Convention: Messrs. George Urban, chairman; C. Lee Abell, Thomas Hodgson, W. W. Sloan, Daniel O'Day, S. F. Eagan, J. M. Brinker, P. P. Miller, James Adams, J. A. Roberts, E. Michael L. B. Crocker, R. K. Noye, F. A. Bell, A. A. Berrick, James Boland, Arthur D. Bissell, A. R. James, Joseph P. Dudley, F. W. Haydon, F. F. Little, J. N. Scatcherd, W. A. Fenn, C. V. Doty, H. B. Oakman, H. M. Gerrans, Thomas Cary, B. L. Sheldon, F. D. Locke, C. A. Sweet, J. L. Williams, W. G. Case, C. M. Morse, F. P. Jones, W. C. Newman, George H. Lewis, Walter T. Wilson, R. W. Jones and E. G. S. Miller.

Edison Affairs.—Reports have been given currency in the metropolitan press that Mr. Edison feels aggrieved over the turn affairs have taken, and feels deeply his loss of active control in the interests he has organized. One report which finds many believers is that Mr. Edison never realized until recently just how it all has happened. In a conversation between him, Mr. Villard and Mr. Insull, which is said to have occurred within a few days, Mr. Edison is reported as having taxed Mr. Villard with working contrary to his interests in bringing about the consolidation with the Thomson-Houston Company. Mr. Villard thereupon turned to Mr. Insull, so the story goes, and remarked: "Were it not for your mismanagement no consolidation would have been necessary." To this Mr. Insull had no reply to make. The outcome of the whole matter is likely to result in the retirement of Mr. Insull from his present place. It is feared by some that Mr. Edison's disappointment in the present state of his affairs may be so keen as to cause his withdrawal from the consolidated company, which would be generally regretted.

L. H. H.

PHILADELPHIA NOTES

Branch Office of The Electrical World,
927 Chestnut Street, Philadelphia, Feb. 19, 1892.

The Whitemore Manufacturing Company, of Scranton, reports the sale of a large number of motors to the electric railway of Wheeling, W. Va.

The Robinson Machine Company, of Altoona, Pa., claims that its standard motor truck is all steel, of 12 springs, non-oscillating, indestructible, has a powerful brake, all parts interchangeable, combines simplicity, and is easy riding.

The Delaware Hard Fibre Company, of Wilmington, has recently equipped its factory with a complete plant for manufacturing electrical specialties, and will contract to make fuse blocks, switches, alarm bells, fans, motors and in fact anything in the electrical line.

J. G. Brill Company, Philadelphia, has sold to the Multnomah Street Railway, of Portland, Ore., six cars. These are mounted on four-wheel trucks, capacity being 40 passengers, and are driven by two motors to each car. This company has equipped eight cars for the Fairhaven and Whatcom Street Railway Company, which will be put into service as soon as the line is completed.

The Harrison Safety Boiler Works, of this city, has just received an order from the Methuen Company, of Methuen, Mass., for a 300 h. p. of their improved type of Wharton-Harrison safety boilers. The above firm have used this type of boiler for more than 21 years. They have also recently erected a battery of eight of the Wharton-Harrison type of safety boilers at the House of Refuge, Glen Mills, Pa.

Chief Walker, of the Electrical Bureau, is confident, now, that electric wires for all purposes may be safely and successfully buried. He is prepared to demonstrate the fact by the exhibition of a large number of plants so conducted. There is no longer any doubt about it. Then, why not enforce the ordinance which says that all such wires must be buried? There can be only one reason. The city and citizens of Philadelphia are not properly represented in councils.

J. W. Parker & Co., of this city, report the following sales for C. & C. Motors: One 8-h. p. C. & C. mining motor for Winifrid Coal Company, of Philadelphia; one 5-h. p. motor for Sternberg & Co., of Philadelphia; one 5-h. p. motor for Harding & Dubois, Philadelphia, Pa.; one 7½-h. p. motor for Wm. Sellers & Co, Philadelphia; one 2-h. p. motor for Novelties Manufacturing Company, Philadelphia; one 5-h. p. motor to the Delaware Electric Supply Company, Wilmington, Del.; one 5-h. p. for Edgemoore Bridge Works, Wilmington, Del.

The Management of the Bijou Theatre, of Philadelphia, deserves great credit for the magnificent and novel effect produced through the agency of electricity, in the play which is now on the boards, "Iolanthe." In the fairy scene, small incandescent lamps of various colors are used. The general lighting of the theatre is reduced so that when the fairies make the electrical connection by means of their feet, their crowns blaze with light. The electrical feature is not confined to this alone, as there are many others, and the effect is really magnificent.

A Philadelphia Paper Remarks.—The action of Council's Electrical Committee in recommending the appointment of a joint special committee for the purpose of investigating the Electric Trust is the right thing to do and has a clear ring of common sense about it. Councils should appoint such a committee without hesitancy, and the sooner the better. The people want to know why it is that the city is forced to pay exorbitant rates for its electric lighting, and there is no doubt the special committee can find out what will be extremely interesting. No half-hearted investigation will be satisfactory, and this committee might as well remember this at the outset. The people want the facts.

Long Distance Telephone Exhibition.—A large audience, consisting of prominent manufacturers and merchants, with a sprinkling of city officials, gathered at the Manufacturers' Club recently to witness an exhibition showing the working of the long distance telephone. The affair was arranged by the American Telephone and Telegraph Company, and was carried out successfully. The opening remarks were made in the office of the company in Cortlandt street, New York, and were heard distinctly in the assembly room of the club by means of funnel-shaped receivers placed in the middle of the room. The musical programme, consisting of cornet solos, banjo solos and vocal music, was also distinctly transmitted from New York. President Dolan then held a conversation with a representative of the company at the other end of the wire, which was overheard by the audience by means of a number of individual receivers.

The block signal system, which has been in partial operation upon the Philadelphia division of the Baltimore & Ohio Railroad for the past year, was completed by the addition of seven more signal towers, and is now working upon the entire section from Philadelphia to Baltimore. The seven new towers that complete the block system are included in the 25 miles of track between West Junction, the station that connects the main line with Landenberg, and the Susquehanna River. The towers were finished on Sunday night and at six o'clock Monday morning the operators were all on hand prepared, at a given signal, to begin work. At seven the signal was given and the system was in complete operation from this city to Baltimore. The Baltimore & Ohio has now 292 miles of track upon which this system is used, one of the longest distances of any uninterrupted line of signal towers in the history of railroading.

W. R. W.

WESTERN NOTES.

Branch Office of The Electrical World,
465 The Rookery, Chicago, Feb. 19, 1892.

Mr. H. T. Paiste, of Philadelphia, made some pleasant personal calls on the trade during the week.

The Central Electric Light and Power Company has requested permission from the City Council to construct and operate its lines in the streets, avenues, alleys, and tunnels of the city for twenty years, together with all necessary feeders to be used exclusively for the work of furnishing light and power and transmitting sounds and signals. All of the conduits, lines and conductors are to be underground.

Messrs. Barton & Brown, of Chicago, are fitting up a handsome suite of law offices in the new sixteen story Monadnock building, adjoining the Union League Club and facing the Post Office, at the corner of Jackson and Dearborn streets, and expect to occupy them in the latter part of April. Being on the fourteenth floor the offices afford a grand view of the eastern and southern portions of the city, and will be made as attractive and convenient as possible by suitable interior arrangements and furnishings.

Boiler Explosions.—In the Appellate Court, Chicago, an opinion has been rendered reversing a judgment for $5,000, the court saying: "The owner and operator of a steam boiler is not an insurer of the absolute safety of the boiler nor a warrantor of the absolute competency of his employés. The law devolves upon him the duty of exercising care and diligence to furnish suitable instrumentalities and appliances, and to keep the plant free from defects which are dangerous, and to select for its operation and management skillful and prudent servants. This is the extent of the burden upon him."

The "C. & C." Electric Motor Company has established a branch in this city, and will occupy the large ground floor store at 201 Madison street, where the company will carry in stock all sizes of the "C. & C." motors and dynamos; also parts of the same for replacing worn or broken machines. Users of electric power located in the West are cordially invited to call. The intention in establishing this branch office is to extend the same privileges to the purchasers in Chicago, both as respects prices and delivery of machines, that would be obtained by direct application at the company's factory in New York.

Mr. Willard W. Low, president of the Electric Appliance Company, recently returned from an extensive business trip, and reports that while he finds business rather quiet, he did not let a single day go by without sending in something substantial in the way of an order, and had on the whole a very successful trip. This company has just closed arrangements with the Ries Electric Specialty Company to control the sale of its socket in certain Western territory, and is making active preparations to thoroughly introduce this valuable specialty, and will carry a large stock on hand in Chicago at all times.

The Chicago Writing Telegraph Company has asked permission from the City Council to construct and operate in the public streets, alleys, conduits and tunnels of the city of Chicago, and under the Chicago River and its several branches a line or lines of wire or electrical conductors for the transmission of communications and signals by means of electricity. Provided, that the surface of the street shall not be disturbed for the purpose of laying conduits until the close of the World's Columbian Exposition in 1893, other conduits being leased in the meantime, if required. In the more distant sections of the city the ordinance provides that the wires may be placed on poles, which, however, must be removed at the end of five years, when the wires may be placed in conduits. It is provided that the city may use the crossarms for its wires; that the police stations, fire engine houses, and public offices of the city be supplied with instruments and connection gratis; that not more than $75 a year be charged to private parties for instruments.

The Columbia Electric Transmission Company, of Chicago, has been incorporated by Gustave Monrath, Charles G. Armstrong and Clarence Griggs, with a capital stock of $500,000, primarily to make an exhibit at the World's Fair, demonstrating the practibility of long distance transmission of electric currents in large quantities, etc. Mr. Armstrong was formerly connected with the Monitor Electric Company, and in an interview at his office in the Auditorium, said: "We are now making arrangements by which we will control a waterfall of 2,000 h. p. at Marseilles, Ill., a town 80 miles from Chicago, on the Chicago, Rock Island & Pacific Railroad. A plant will be erected there, wires strung, and by means of high tension currents this will give us at least 1,500 h. p. in Chicago. As the cost of each horse power in this city at present is $70 a year, at that figure we should have an income of $105,000 a year from this plant alone, and the cost to us would be merely nominal. We shall have everything ready and the plant in operation by the time the World's Fair opens, and will make an exhibit in the Electrical Building, where the power may be used for lighting and other purposes. Mr. Monrath and myself are the electrical engineers and we are confident the venture will prove a success."

F. De. L.

Tacoma, Wash., Feb 17, 1892.

The Great Northern Telegraph Company has opened its lines from Seattle to South Westminster.

Mr. Henry Hutton, the electrician of the Tacoma Railway and Motor Company, has resigned his position.

The Seattle Gas and Water Company is running a number of Wood arc lamps from its central station.

Mr. J. T. Reynolds, of Seattle, it is stated, will expend $12,000 in installing an electric light plant in the town of Sidney, Wash.

Mr. Leo Daft, the inventor and electrical engineer, has ceased to sell to the retail trade, but is still carrying on his supply house.

The Seattle General Electric Company is operating an increased number of arc and incandescent lights on its commercial circuits.

The Union Trunk Line (electric). E. F. Wittler, president, has adopted the Thomson-Houston car equipment as its standard, after a trial of other apparatus.

G. H. R. Preble recently became connected with the Northwestern Thomson Houston Company, having severed his relations with the Edison General Company.

The Western Union Telegraph Company is building a new line north of Seattle. The telegraph line is nearly completed from Everett to Snohomish along the line of the "Three S" railroad.

The Rainier Light and Power Company, of Seattle, Thomas Denny, manager, has extended its lines from its Edison electric light and power station, to accommodate the residence section of the city.

The Northwestern Thomson-Houston Company, through its Seattle agency, E. B. Kittle, manager, has sold a 250,000-

watt railway generator to the James Street Company, of Seattle, which company also uses the Thomson-Houston car equipment.

The Sunset Telephone Company's Seattle exchange, A. J. Clark, manager, has recently added a 250-drop section to the switchboard in its central office; 825 telephones are now in use, the average gain being 15 a month. The new line from Snohomish to Everett is nearly completed, and will be extended to Seattle. A new copper line will be constructed between Seattle and Tacoma.

The Home Electric Company, of Seattle, E. C. Kilbourne, vice-president and general manager, A. L. Hawley, assistant manager, has now a central station capacity of 5,400 Thomson-Houston and Westinghouse alternating current incandescent lights and 300 Waterhouse arc lights. The dynamos for the light circuits and also the power generators, capacity 50,000 watts, are driven by A. & S. Gross compound condensing engines of 900 h. p.

The Edison General Electric Company, through its Seattle agency, has recently sold the following electrical apparatus: To the New Westminster and Vancouver Tramway Company two 225-h. p. railway generators and an additional single-reduction car equipment; to the National Electric Tramway and Light Company, two single reduction car equipments. One single reduction equipment has also been accepted by the Union Trunk Line of Seattle.

The Washington Electric Company, under A. E. Brayner, manager, has shown great activity since its inception a few weeks ago, and twelve miles of poles have been erected, supplying lights to a desirable residence district and tapping the business centre. In addition to considerable residence work, it has installed in the Seattle court house, 430 T.-H. alternating current incandescent lamps, which will be operated from the new station which will be started up next week.

G. R. DE V.

News of the Week.

THE TELEPHONE.

The Telephone Law.—Citizens of Baltimore, Md., for some time past have been agitating the question of better telephone rates and of having a bill presented to the Legislature, now in session at Annapolis, to bring about a needed change in the matter of telephone charges. Little seems to have been done in the matter thus far, and it looks as if the agitation and the bills introduced have gone into innocuous desuetude. A Baltimore journal recently commented as follows in regard to the matter: "Reflecting people are of the opinion that a law ought to be passed establishing maximum rates for telephone service. There, of course, should be a fair return to the corporation for the expense of maintaining the instruments and answering calls. Then, too, the kind of service to be rendered should be defined by statute, so that the company may not take the price established and allow instruments and lines to deteriorate. In short, the relations between the telephone company and its patrons should be fully defined, and rates so adjusted as to be fair and equitable to both parties to the contract." A similar statute would be very desirable for New York State and a movement in that direction is being made.

THE ELECTRIC LIGHT.

Karl Park, Ind.—An electric light plant is to be put in.

Cannonsburgh, O.—An electric light plant is to be erected.

Ukiah, Cal.—An electric lighting plant is being put in, and will soon be in operation.

Chestertown, Md.—A move is being made to put in an electric light plant in the early spring.

Elkhorn, Wis.—The project of putting in an electric light plant is being agitated by W. A. Barnes.

Auburn, Ill.—A stock company is being formed for the purpose of establishing an electric lighting plant.

Prospect, O.—The town is to be lighted with electricity. Watkins & Wyant have the contract for the plant.

Braddock, Pa.—A stock company is being organized for the purpose of putting in an electric light and power plant.

Hyattsville, Ind.—The town Commissioners, it is stated, are negotiating for the putting in of a town electric lighting plant.

Dundee, Mich.—The City Council has granted a franchise to the Dundee Electric Light Company, and contracted for 16 arc lights at $60 each.

Indianapolis, Ind.—The bids of both the Fort Wayne Electric Company andthe Brush Company for lighting the city were rejected and the city will readvertise.

Portland, Oregon.—A 300-light Eddy lighting plant has been installed in the Gilman Hotel by the North West Electric Engineering Company. It is operated by a 24 hp. Eddy motor.

Sing Sing, N. Y.—The Sing Sing Gas Manufacturing Company, recently organized, has petitioned the village board for a 20-year franchise for lighting the village with electricity.

Davenport, Ia.—The Davenport Electric Light and Power Company has added a new Thomson-Houston dynamo to its plant, having a capacity for 1,350 incandescents, and another of 650-light capacity is being installed.

Montreal.—Citizens of St. Jean Baptiste ward will soon have the benefit of the electric lights in their residence A syndicate recently formed will erect the apparatus and has closed a contract with Mr. A. J. Corriveau for an alternating plant of the Slattery system.

Delaware, O.—The authorities of the university are considering the subject of an electric light plant for the use of the college. The plan is to establish a plant with sufficient power to illuminate all the buildings and to fit it with appliances for practical class work. It is thought this plan, if carried out, will form the nucleus for a new department of electricity to be placed in the general department of science.

To Have Electric Lights.—Messrs. G. A. Wurdeman, of Fairview, Miss., Stanley Simmons, of Webster Groves, Mo., and Walter Kransnick, of Old Orchard, Mo., representing a wealthy syndicate, contemplate erecting and operating an electric light plant at Webster Groves, to furnish light for Webster Groves, Greenwood, Shady Side, Old Orchard, Shrewsbury Park, Selma, Fairview, Kirkwood and other suburbs along the Missouri Pacific and Frisco. They propose to have the plant in operation one year from the time the franchise is granted.

ELECTRIC RAILWAYS.

Forsyth, Ga.—It is possible that this town may be connected with Macon by an electric line, a survey having already been made.

Portland, Oregon.—The Multnomah Street Car line has received six new Brill cars, fitted with single reduction motors. The power station of the Union Power Company has been started up again.

Against a Railway in Pelham Manor.—The taxpayers of Pelham Manor, N. Y., have decided not to permit the Yonkers and Mount Vernon Electric Railway to pass through the place, and the incorporators will have to change the route and go through Westchester or New Rochelle. The Manor people give as a reason for their action that the road would bring to their village undesirable persons on Sunday.

The Chicago City Railway Company intends to use electricity as a motive power on all its cross town lines, according to the following statement made by one of the directors recently: We propose to place electricity as a motive power on every one of our cross-town lines, and will ask the City Council soon for an enabling ordinance for that purpose. The cable lines will continue as at present. We are especially anxious to put electricity on Sixty-third street to connect the State street line with the World's Fair grounds.

Vestibuled Electric Trains.—The Avondale Electric Railway, of Cincinnati, O., is the first to adopt an idea that has been found practical on steam roads. On this new line just opened to one of Cincinnati's suburbs several vestibuled trains are running. The number will be increased to 20. The new cars have created no small amount of discussion in the electrical world. Protection for the rheostat—the contrivance for the regulation of the strength of electrical currents—was badly needed. These have been placed beneath the car where exposure to rain, snow and slush has proved most disastrous. In the vestibule trains this danger is obviated. The motor man occcupies the cab all by himself, and the rheostat is enclosed in the vestibule.

GENERAL APPLICATIONS OF POWER.

The Thomson-Houston company has forwarded to Washington its electric motor for controlling all the motions of the eight-inch gun, and it will be tested in the Washington Navy Yard.

Electricity as a motive power in coal mines is gradually superseding mules and the latter must go. Several large coal companies in the vicinity of Pittston, Pa., among them the Delaware, Lackawanna & Western and the Hillside Coal and Iron Company, have been experimenting with electricity in their mines. At the Erie Colliery of the latter company a complete electrical hauling plant is in operation. It consists of a 60 h. p. Thomson-Houston generator. The engine and dynamo room is in charge of the engineer and his assistant, who operate the other machinery, and, therefore, no extra hands are needed. The electric locomotive is run by one man, it is stated, who is assisted by a boy in making up the trains and turning the switches. The locomotive displaces seven mules and three drivers. During a period of 112 days the average number of cars delivered at the shaft bottom by the locomotive was 559, against 526 per day delivered by mules. With the electric locomotive 709 can be hauled in ten hours without extra expense. Besides this hauling power the current is used for lighting purposes, so that in every part of the mine there is abundant light. Altogether, the system is declared by the managers to be a great improvement, and the company will in the near future extend it to its other works.

LEGAL NOTES.

In Contempt.—The Supreme Court, General Term, has affirmed the order adjudging Directors A. C. Bernheim, Eugene Hammett and Charles L. Bernheim, of the Harlem Lighting Company, of New York, guilty of contempt of court in transferring $200,000 worth of stock to the Manhattan Electric Light Company, of New York, in violation of an injunction from the court.

A Decision on Railroad Telegraphs.—Justice Harlan has rendered a decision sustaining the jurisdiction of the Circuit Court for the Northern District of California in the case of the United States against the Southern Pacific Railroad Company, the Southern Railroad Company, the Atlantic and Pacific Railroad Company and the Western Union Telegraph Company, to compel the companies to operate their telegraph lines in accordance with the act of Aug. 7, 1888.

In the United States Circuit Court, at the March term, at Trenton, N. J., a novel exhibition is to take place, when a complete electric light outfit is to be working in the courtroom during the trial of the suit between the Edison Electric Light Company and Westinghouse, Church, Kerr & Co., over a patent on the mode of electric distribution. The Edison company claims that Edison is the original inventor and owner of the system, and that the same is being used by the defendant company and is an infringement. It being impossible to have the court understand all the intricacies of the business, the difficulty is to be overcome by placing a boiler and dynamo in the cellar of the Federal Building and the other apparatus, with lights, in the courtroom. Westinghouse, Church, Kerr & Co. will also erect a working model for the court. The case will continue for two weeks.

MISCELLANEOUS NOTES.

The Electric Time Service is to be discontinued by the Harvard Observatory after March 1.

The Executive Committee of the Canadian Electrical Association met at Toronto recently. There were present Mr. J. J. Wright, president, in the chair; Mr. K. Dunstan, first vice-president; Mr. C. H. Mortimer, secretary-treasurer; Messrs. D. Thomson, T. H. Wadand, Hamilton; A. B. Smith, Toronto; E. S. Edmonson, Oshawa; John Yale, Guelph; S. J. Parker, Owen Sound, and H. O. Fish, Peterboro. A large number of applications for membership were presented to the meeting and passed upon by the committee. Arrangements for the first annual convention to be held at Hamilton on the first Tuesday in June were discussed and several subcommittees appointed to further these arrangements and report progress at another meeting of the Executive Committee to be held on the second Wednesday in March. Communications will be sent to manufacturers of electric apparatus with a view of securing an interesting exhibit of this class of apparatus at the approaching convention. Several gentlemen holding prominent positions in connection with electrical industries have signified their willingness to prepare papers to be read at the convention, and there is no doubt that the event will prove to be very interesting and profitable to those interested in electrical matters.

Industrial and Trade Notes.

The Laidlaw & Dunn Co., of Cincinnati, O., has been awarded the contract for pumping engines, boilers, heaters, etc., for the new water-works of the town of Olney, Ill.

The E. Eldred Magic Specialty Manufacturing Company, of Milwaukee, continues the business of the firm of Magie Bros., recently dissolved, in the manufacture of the same line of electrical goods, with an additional line of specialties.

The Ball Engine Company, of Erie, Pa., reports the following sales: One 35 h. p. to the New England Conservatory, of Boston; one 200 h. p to the Columbia Electric Light Company, of Philadelphia; one 300 h. p cross compound engine to the Edison Electric Light and Power Company, of Minneapolis; one 100 tandem compound, two 200 and two 100 cross engines to the Palace Hotel Company, of San Francisco.

The C. & C. Electric Motor Company, owing to an increasing demand for its motors from the Northwest, has opened a branch establishment in Portland, Ore., which is located at 53 and 55 North Front street, where all sizes of the "C. & C." motors and dynamos and parts of same for replacing worn or broken machines will be carried in stock. This will be a great convenience to parties located in that territory having business with the company.

The Berlin Iron Bridge Company, of East Berlin, Conn., have taken the contract for a new boiler shop for the Dry Dock Engine Works at Detroit, Mich. The building will be 68 feet in width by 201 feet in length, will be designed and constructed from the foundations by this company, and not only the iron work, but the foundations, brick work, and in fact the whole building complete, ready for the machinery, will be furnished by the Berlin Company.

The Poole Electric Company, of Lynchburg, Va., has discontinued, keeping a stock of general supplies and only keeps on hand a stock of Economic incandescent lamps, together with such other specialties as Moore's wires and lamp cords, Zurn's dynamo and engine oils, etc. After April 1 the Poole arc lamps will be ready for the market. The specialties made to order by the company are railway generators, arc and incandescent dynamos and constant potential motors.

The Crocker-Wheeler Electric Company, of New York, had on exhibition a full line of motors, fans and pumping outfits automatic switches, etc., at the Crystal Palace Exposition through their agents, the General Electric Company, Limited, of London, and as a result of the exhibit has made arrangements with Messrs. Crompton & Co. to handle Crocker-Wheeler machines in connection with their own of larger size, this arrangement having been made by special arrangement with the General Electric Company, who are the sole representatives of the Crocker-Wheeler Electric Company in London.

The Engineering Equipment Company, Central Building, Liberty street, New York, which was recently appointed sole Eastern representative of the Syracuse (N. Y.) Tube Company, reports a satisfactory demand for the tube poles manufactured by the Syracuse company. These poles are designed specially for street railway work, and those who have used them report that they give the best of satisfaction. It was erroneously stated in our issue of Feb. 6 that Messrs. Perrine and Crane, of the Engineering Equipment Company, had been appointed agents for the Syracuse Tube Company, but the statement should have read as above.

Mr. A. L. Bogart, of 22 Union Square, New York, is meeting with great success in the sale of his new medical battery. This is arranged in compact form with four small cells. The zincs are placed in an aperture on one side, so that nothing in the way of material is being consumed except when in actual use. By simply placing the zincs in each cell and closing the lid the full strength of the battery is obtained. It has been found very valuable for running dental mallets, small motors, and in fact useful in all sorts of surgical and dental work. A great many foreign orders have been received. Another novelty of this firm is its dynamo-electric gas lighter, which is meeting with great success.

The Pelton Water Wheel Company has recently issued a new edition of its catalogue, which embraces a vast amount of tabular and descriptive matter relating to the means of utilizing water powers by the Pelton system, making quite the most valuable contribution to modern hydraulic literature that is now available. Much attention is given to the generation of power for electric transmission, which is now the absorbing question in electrical science. The system described makes possible the utilization of this source of energy under a wide range of conditions and with a degree of economy, simplicity and efficiency never before attained. Engineers as well as parties interested in the development of water powers will be furnished a copy upon application to the Pelton Water Wheel Company, 143 Liberty street, New York, or 121-123 Main street, San Francisco, Cal.

The Edison General Electric Company, through its Pittsburgh branch, closed the following contracts during the past few weeks. To the Uniontown Street Railway Company, Uniontown, Pa., 270 h. p. outfit and six cars, 12 motors. Erie Electric Motor Company, Erie, Pa., 560 h. p. dynamos. Leader Publishing Company, for 270 light dynamo; Wilson Snyder Manufacturing Company, Pittsburgh, Pa, 210 light dynamo; Emil Winters, 450 light dynamo; Schmulbach Brewing Company, Wheeling W. Va., 250 light dynamo; H. M. Myers & Co., Beaver Falls, Pa., 270 light dynamo; New York & Penna. Co., Johnsonburg, Pa., 500 light dynamo; Buckhannon Electric Light Company, Buckhannon, W. Va., 750 incandescents and 50 arc lights; Johnstown Electric Light Company, Johnstown, Pa., 100 arc lights; C. Jutte & Co., Pittsburgh, Pa., 5,000 c. p. search light outfit. Business with the supply department, as well as the fixture department, has proven very successful, and business has been very encouraging for this season of the year.

One of the difficulties in the way of the installation of the incandescent light in residences and other buildings has been the difficulty in obtaining a reliable and durable wire of high insulation and the risk and danger of fire. The fire and weatherproof wire manufactured by Alfred F. Moore, of Philadelphia, is designed to combine in a great degree protection from fire caused by heat generated in the conductor, and protection from moisture. The successful results obtained are shown, it is stated, by the indorsements given by the many architects who are specifying Moore's fire and weather proof wire for use in new buildings. Another advantage claimed is the low price of these goods, and contractors in Philadelphia, New York, Pittsburgh, Chicago, and elsewhere have evidenced their appreciation of the wire by large orders. The house of Alfred F. Moore is also agent for the sale of the Bishop Rubber Covered Wires and Cables, whose high insulation wires are well known for their excellence and durability. Their new "Bishop Braided" is meeting with marked success.

The Syracuse Tube Company, of Syracuse, N. Y, has increased its floor space and capacity for the manufacture of iron poles for railway purposes. Several large orders have been filled during the past fall and a larger business is anticipated for the opening of spring operations. Its sales agents, Engineering Equipment Company, 143 Liberty street, New York, and 126 Pearl street, Boston, who are pushing the pole with energy, recently sent in an order for a sample pole which was filled with the greatest promptitude. The manufacture of the pole necessitated the drawing of certain sizes of pipe, the making of the joints, putting together and, finally, painting and running on the cars ready for shipment—all of which was accomplished before noon of the same day. Under the

circumstances this may be considered quick work and serves well to illustrate the facilities of the Syracuse Tube Works for the filling of hurried orders. When pushed, its capacity can be made as high as seven or eight hundred finished poles a week, or over a hundred a day, which, in addition to stock carried, is usually sufficient to meet the requirements of the largest contracts.

Business Notices.

The Mather Electric Motors combine the highest efficiency and workmanship consistent with a reasonable first cost. Perfect automatic regulation of speed from no load to full load. For catalogues and information address E. T. Pardee, agent, 11 Butler Block, Syracuse, N. Y.

A Central Station Plant for Sale.—Parties desiring to secure a well established central station plant in a prosperous town in central Illinois should read the "for sale" notice in our advertising columns, headed "An Excellent Opportunity." The sole reason for selling is the continued ill-health of the proprietor's family, necessitating removal to Southern California.

Partrick & Carter Company, of Philadelphia, advertise their "New" Box Bell in this week's issue. This bell possesses many points of merit and is likely to be well liked by the trade. They are made in three sizes only at present, of the regular woods, such as walnut, oak, cherry, ash, plain and antique oak and cherry stain. The circular which the firm has issued gives special prices according to quantity ordered.

The Buffalo Convention.—Western delegates to the annual meeting of the National Electric Light Association, to be held in Buffalo, New York, on Feb. 23, 24 and 25, may have reserved for them berths, state room or section, in the elegant sleeping cars of the Chicago & Grand Trunk Railway, which leave Dearborn Station, Chicago, as follows:

Leave Chicago	11:25 A. M.	Arrive in Buffalo	4:20 A. M.
" "	3:00 P. M.	" " "	8:00 A. M.
" "	8:15 P. M.	" " "	5:50 P. M.

By applying personally or by letter to E. H. Hughes, General Western Passenger Agent, 103 S. Clark street, cor. Washington street, Chicago.

The National Electric Light Convention, Buffalo, Feb. 23 to 26.—Are you aware that the next meeting of the National Electric Light Association will be held at Buffalo, Feb. 23 to 26, and will be one of the most important in the history of the association? Owing to the importance of this meeting the railroads throughout the East and West will grant low rates, and the Michigan Central, "The Niagara Falls Route," in addition to making a rate of $18 from Chicago to Buffalo and return, announce that they will have special cars attached to their New York Vestibuled Express, leaving Chicago at 3:10 P. M., Monday, Feb. 22, arriving in Buffalo early the next morning, for the use of delegates and others going from the West. Applications for space should be made as early as possible to Mr. L. D. Heusner, passenger and ticket agent, Michigan Central Railroad, No. 67 Clark street, Chicago, who will also issue tickets at the low rate announced. It should be understood that this low rate is applicable to all who desire to attend, including delegates, members of their families or supply men.

Delegates to the Annual Meeting of the National Electric Light Association at Buffalo will leave Chicago Monday afternoon, Feb. 22, and arrangements are being made for conveying them in special vestibuled sleeping cars attached to the 3:10 P. M. train of the Lake Shore & Michigan Southern Railway, arriving at Buffalo at 7:30 Eastern time the next morning. Any who find it more convenient to leave later can take the Limited at 5:30 P. M., arriving at 8:40 A. M., Eastern time. Of the half dozen daily trains returning, the most convenient leave Buffalo at 11:50 A. M., 7:20 P. M., and 11:08 P. M., all Central time, arriving in Chicago respectively at 7:35 A. M., 9:30 A. M., and 3 P. M., the next day. It will be seen from the above the trip by this route in either direction, may be made in a single night's travel, an advantage over any other line of half a day's time saved on the return journey alone. Tickets for the round trip, $18 on the certificate plan; berths $3 each way; $1 extra going on the limited. For reservations, certificate and any information address John L. Martin, of Committee on Transportation, care of Chicago Electric Club, Chicago: or C. K. Wilber, W. P. A., Chicago.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

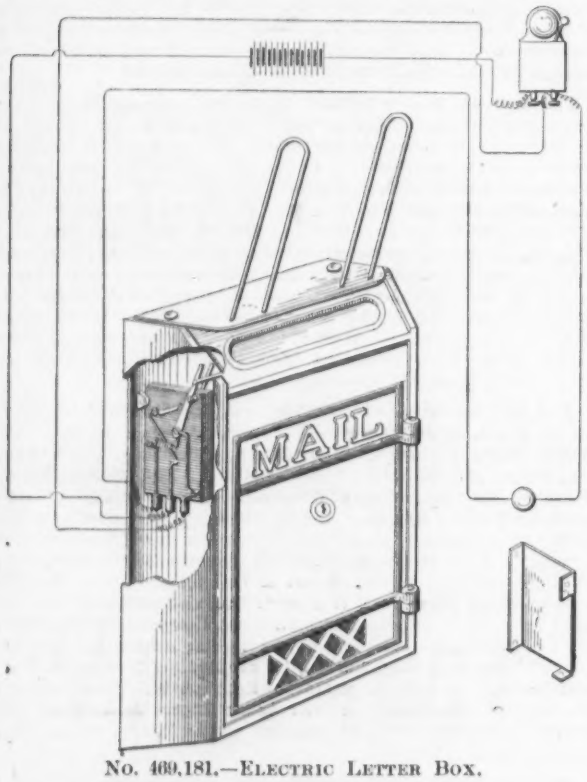
U. S. PATENTS ISSUED FEB. 16, 1892.

468,779. Trolley for Electric Cars; John W. Beebe, of Waterloo, N. Y. Application filed March 10, 1891. The combination, in a trolley device of the class hereinbefore referred to, of a trolley wheel having a comparatively large central opening or chamber, a group of concentrically arranged anti-friction rollers passing across said chamber and journaled in said wheel, and a trolley axle or bearing made in part of anti-friction metal and passing centrally between the rollers forming said group.

468,787. Signal for Electric Railway Systems; Frederick A. Cheney, of Elmira, N. Y. Application filed Sept. 10, 1891. The combination, with a single track divided at intervals into the up and down branches of turnouts and trolley wire following the line of the track and its branches, of a circuit closer in each up and down branch of the turnouts and adapted to be moved or operated by the trolley of a passing car on the branch with which it is connected, signaling instruments on opposite sides of and near the turnouts and adapted to be encountered by the trolleys of cars passing on the main track and thereby reset or restored to indicate a clear track, and derived or branch circuits from the main or trolley wire leading from the circuit closers on the up and down branches of the turnouts respectively, and grounded through the signaling instruments at the distant ends of the sections in advance of the same.

468,807. Magnetic Lock; Alcuin E. Kintner, of Painesville, O. Application filed Sept. 3, 1891. In a magnetic lock the combination of a series of tumblers arranged loosely within a cylinder, the cylinder being within a casing having an opening therein, and a pivotal cross-arm operating conjointly with a pin attached to the cylinder, and in contact with the cross-arm, actuated by a grooved magnetic key.

468,818. Multiple Switchboard; Walker Moseley, of London, England, Assignor to the Western Electric Company, of Chicago, Ill. Application filed Dec. 26, 1888. The combination, with two or more switchboards with which telephone lines are connected, of chain toggle devices, one for each of the telephone lines,



No. 469,181.—Electric Letter Box.

each of said chain toggle devices being drawn taut by the insertion of a plug in any switch of the line corresponding thereto, to lock the other switches of the line on the other boards out of employment.

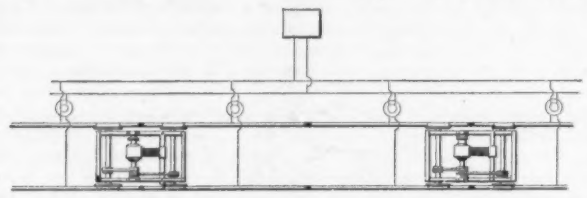
468,887. Electrolyte or Depolarizing Solution for Galvanic Batteries; Samuel Miller, of London, England, Assignor to Evelyn Glover, of same place. Application filed Oct. 16, 1891. An electrolyte or depolarizing solution consisting of or containing nitrate of soda, bichromate of potash, chloride of sodium, and a suitable acid.

468,903. Electric Elevator; Rudolph C. Smith, of Yonkers, N. Y., Assignor by mesne assignments to the National Company, of Chicago, Ill. Application filed Aug. 23, 1891. The combination, with an electric motor, of a reversing switch, resistances operated by said switch, independent additional resistances in the armature circuit, a contact brush for said additional resistances, positively connected to the main switch during the first part of the travel of the switch, but free to move when released, electrical devices controlling said contact brush against the action of the current in said electrical device, and means to increase resistance in the field magnet coils after all other resistances are cut out.

468,912. Turn-Table Connection for Electric Railways; Rudolph M. Hunter, of Philadelphia, Pa., Assignor by mesne assignments to the Thomson-Houston Electric Company, of Connecticut. Application filed Feb. 17, 1886. In an electric railway, the combination of a main line and one or more branch tracks, each provided with an electric conductor parallel to and independent of the track rails, a centrally pivoted turn-table or bridge arranged in the path of said main line and provided with track rails, and an electric conductor parallel to and independent of the said rails, and means to supply electric current to the conductors of the main line and branch tracks and turn-table or bridge, whereby an electrically propelled vehicle may receive current while being transferred by the turn table or bridge.

468,938. System of Distribution of Electrical Heating Currents; George D. Burton, of Boston Mass., Assignor to the Electrical Forging Company, of Maine. Application filed May 14, 1891. In an apparatus for distributing electric currents for heating purposes, the combination of an electric converter, conducting rods extending therefrom, adjustable clamps on said conducting rods, conductors leading from said clamps to different electric heaters, and rheostats disposed in the branch circuit of each heater.

468,948. Electrically Propelled Car; Harry E. Dey, of Brooklyn, N. Y., Assignor of one-half to Frederick B. Griswold, of Hartford, Conn. Application filed July 14, 1891. The combination, on an electric car, with the cog wheel or piston shafts of two rotary pump engines secured to the car on its tracks, of an armature mounted on one of said shafts, a field magnet mounted on the other, the said armature and field magnet being associated to



No. 468,949.—Converter System for Electric Railways.

constitute an electric motor and being independently rotatable, driving axles, a rotary pump or field motor for each axle, having one of its cog wheels or pistons mounted on the axle, and pipes connecting each of said pumps with the engines.

468,949. Converter for Electric Railways; Thomas A. Edison, of Llewellyn Park, N. J. Application filed March 8, 1887. In an electric railway, the combination, with a moving car and an electric motor carried by such car, and proportioned for operation by low tension currents of contact conductors, with which such car makes a traveling contact, a main supplying circuit extending along the line of the railway, and having a current of high tension, and a number of tension reducers located at intervals along the line of the railway and near thereto, such tension reducers being connected in multiple arc with the said main supplying circuit, and being also connected in multiple arc with the said contact conductors, and producing a current of lower tension upon the latter. (See illustration.)

468,950. Commutator Brush for Electric Motors and Dynamos; Thomas A. Edison, of Llewellyn Park, N. J. Application filed April 4, 1891. The combination, with a commutator cylinder of a commutator brush having several current collecting devices, each independently movable in a direction toward and from the commutator cylinder, and a resistance connected to each collecting device. (See illustration.)

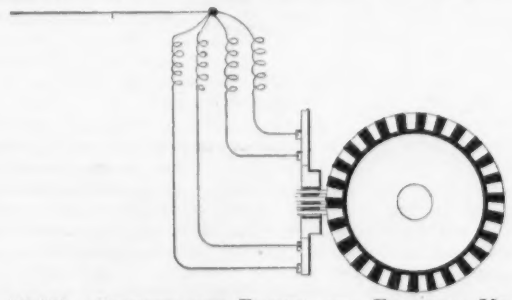
468,953. Field Magnet for Dynamos and Motors; Robert Lundell, of New York. Application filed June 6, 1891. The combination, in an electromagnetic machine, of an armature, a flattened field magnet frame or yoke having three pole pieces on each end, and intermediate pole pieces on the two longer sides.

468,959. Electric Railway; Frank J. Sprague and Patrick F. O'Shaughnessy, of New York, Assignors to the Sprague Electric Railway and Motor Company, of same place. Application filed Jan. 19, 1889. In an electric railway, the combination, with an overhead electric conductor for receiving an underneath contact, of a switch plate connected therewith and a guiding rib on the under side of said switch plate, on which the contact device travels in crossing said switch plate.

468,970. Means for Indicating Discharge from or into Hoppers; Frank H. Briggs, of Cleveland, O. Application filed April 29, 1891. The invention consists of a hopper and a scale, the scale beam being adapted to make and break an electric circuit by its up and down movements. The circuit includes an alarm or means for automatically cutting off the discharge into or from the hopper.

469,041. Electric Arc Lamp; Robert S. Dobbie, of Jersey City, N. J. Application filed Oct. 23, 1890. In combination with the other operating parts of an arc lamp, a feed disc, a brake therefor, spring toggles for operating the brake, a solenoid included between the terminals of the lamp, an armature therefor attached to the said toggles for retracting the brake, a second shunt winding on said solenoid open circuited at contacts, toggles for closing the said contacts, and actuated by the said solenoid against the action of a spring, and a starting magnet, presenting salient poles to the faces of the feed disc. (See illustration.)

469,050. Electric Search Light; Nelson Weeks, Jr., of Long Island City. Application filed June 4, 1891. The combination of



No. 468,950.—Commutator Brush for Electric Motors and Dynamos.

a case or drum, a lens mounted therein, and an arc light and its frame supported by said drum, with the carbon pencils parallel with the axis of the lens.

469,085. Telephone Transmitter; Elwood A. Grissinger and Theodore Grissinger, of Mechanicville, Pa. Application filed Sept 16, 1891. In a telephone transmitter, a diaphragm consisting of a film of suitable material, inclosed by a substantially homogeneous strongly coherent body of carbon.

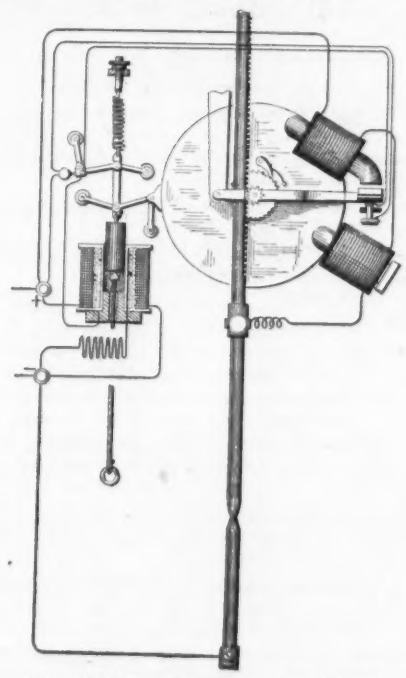
469,093. Electric-Arc Lamp; Houghton Sawyer, of San Francisco, Cal. Application filed Feb. 24, 1891. In an electric-arc lamp, a magazine for containing upper and lower carbons, a pair of carbon holders, and means for feeding the carbons from said magazine into the pair of carbon holders respectively and successively as required.

469,080. Armature for Dynamo-Electric Machines; Marcel Deprez, of Paris, France. Application filed Dec. 7, 1885. In an armature for a dynamo-electric machine, the combination, with a segmental ring core, of a series of segmental bobbins of refractory insulating material fitting upon the core and an armature coil upon each bobbin.

469,129. Storage Battery; Chaimsonovitz Prosper Elieson, of London, England, Assignor of one-half to Frederick Alfred Pellas, of Oggobio, Italy. An electrical accumulator or storage battery, each electrode of which is built up of a series of juxtaposed corrugated and perforated metal tubes united together by a contact piece, the corrugations of each of the several tubes composing such electrode being at an angle to those of its next adjacent tube or tubes.

469,135. Electric Curling Iron; Alexander F. Godefroy, of St. Louis, Mo. Application filed June 26, 1891. The combination, with a pair of hair-curling irons having one member provided with a smooth curling surface adapted to curl hair, of an electric resistance normally located within said curling member of the iron and arranged to radiate heat outwardly, the curling surface of said iron being thereby heated by radiation from said resistance, and mechanical and electrical connections between the source of electricity, whereby the current may be supplied to the coil and the iron rotated without disturbing the electrical connections.

69,181. Electric Letter Box: Charles A. Pinkham, of Wollaston, Mass. Application filed July 3, 1891. The combination, with the electric circuit and the alarm or indicator included therein, of a letter-box or other receptacle provided with a circuit closer operated by the introduction of a letter or other matter within the box to actuate the alarm or indicator, a branch circuit having a push-button or key located at a distant point, and a circuit closer for connecting said branch circuit with the main circuit,



No. 469,041.—Electric Arc Lamp.

said branch circuit closer being actuated by the introduction of a letter or other matter within the box, whereby the presence of such matter can be at any time ascertained by operating the push button or key. (See illustration).

469,193. Dynamo-Electric Machine or Motor; Henry M. Byllesby, of St. Paul, Minn. Application filed June 8, 1891. The combination of concentric oppositely rotatable armature and field magnets, power transmitting devices actuated both by said armature and said field magnets, commutator brushes carried by said field magnets, and insulated contacts carried by said field magnets, electrically connected, respectively, with said brushes and also with the line wires.

469,203. Mechanical Telephone; William H. Eastman, of Concord, N. H., Assignor by mesne assignments to the Pulsion Telephone Company, of same place. Application filed May 7, 1888. In a mechanical telephone, the combination of the diaphragm, a conducting wire, and a spring mounted on and supported by said wire behind the diaphragm, the outer end being free to vibrate.

469,208. Electrical Conduit; Edwin T. Greenfield, of New York, Assignor to the Interior Conduit and Insulation Company, of same place. Application filed May 13, 1891. A system of interior or house conduits consisting of one or more pairs of tubes or pipes running from a central point of distribution to one or more points of consumption, one tube of each pair enclosing the advance and the other tube the return conductor, said conductors being removable therefrom.

469,220. Electric Cut-Out; Van A. Thomas, of Providence, R. I. Application filed May 15, 1891. In an electric cut-out, the combination, with a casing having hooded openings and non-conducting base with central stud, of an oppositely notched insulating disc loosely mounted on said stud, the separated contact plates on the upper and lower faces of said disc, the binding posts with lateral extensions, upper and lower contact plates secured to said extensions to frictionally engage the contact plates on the disc, and an operating lever mounted on the stud and secured to the insulating disc.

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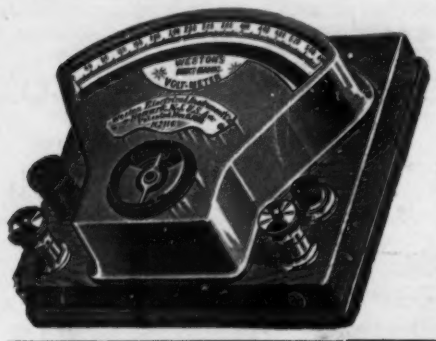

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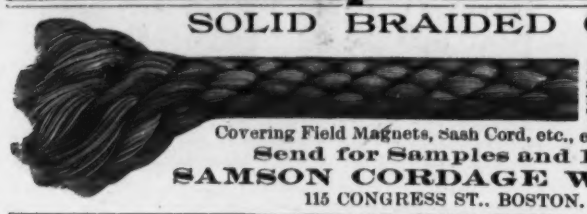

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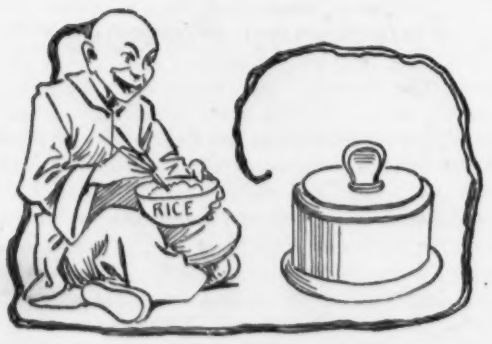

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